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The Card Index System of Cost Keeping.

Very few inventions have been found of so much wider scope than they were originally supposed to be as the card index. Originally intended as a substitute for the blank book indexes of large libraries, it has been found useful in the keeping of all sorts of records and is now receiving a considerable amount of attention for the keeping of machine shop costs, several leading works having adopted it during the past year. Among these is the Bullard Machine Tool Company, of Bridgeport, Conn., and through the courtesy of that company we are enabled to lay their methods before our readers. It is a very common and a very true remark that a system of cost keeping must be adapted to the conditions surrounding its use, these conditions being determined by the class of work being done; and in order to avoid confusion it should be stated that the plan as here developed is used in the manufacture of a defined line of machine tools. These machines are put through the shop in lots, each lot being given a shop order number to which the work on the lot is charged, the identity of the lot being maintained until completed and put in the storehouse. The work is done strictly by manufacturing methods, though these methods do not belong to the class of continuous manufacturing by which sewing machines and bicycles are made, in which no attempt is made to maintain distinct lots of the product. In judging of the merits of this system of cost keeping as here developed, the class of work for which it was intended must be kept in mind.

On entering the works in the morning the workman is given an envelope, shown in Fig. 1, together with a ticket, shown in Fig. 2. As he passes the door this envelope is stamped in the upper left-hand corner with a rubber dating stamp, as shown. In entering again for the afternoon, the envelope is again stamped at the upper right-hand corner with the hour of entering. These stamps are the workman's record of punctuality, and if he leaves on time at noon and night no record of his leaving is made, but should he leave early the hour of leaving is written on the envelope by the foreman. The workman's name and number are also entered, and after the envelope has been surrendered to the foreman at night, the total hours for the day are entered by the foreman and the whole is OK'd by him, a ticket punch being used for that purpose. The workman's number entered is the same as his toolroom check number, the number being used in some of the subsequent records of the work because it can be written more compactly than the full name. No habitual use of this number in the cost records, however, is made, it being only used in spe-

STAMP. STAMP.

DO NOT FOLD

TIME CARD.

MORNING. NOON.

No.

Name

Hours

O. K.

The B. M. T. Co.

FIG. 1.—WORKMAN'S DAY ENVELOPE.

Date 1898.

Name, No.

Job No. Hours

Division

Operation

Name of Piece *Price per Hour.

*Amount

MAKE SEPARATE CARD FOR EACH OPERATION.

O. K.

Daily Service Card,
The B. M. T. Co.

FIG. 2.—DAY JOB TICKET.

cial cases when it is desired to keep a record of the workman who did a given piece of work.

The envelope thus forms the time ticket for the day so far as the workman is concerned, but it carries no record of what kind of work he has been doing. This record is entered on the ticket shown in Fig. 2, a separate ticket being used for each job done during the day, and all tickets for the day being put in the envelope and handed to the foreman on leaving at night. As handed in the envelope thus becomes a time ticket for the purpose of the pay clerk, while the cards divide the work among the jobs done and are cost tickets for the use of the cost clerk, and after being verified and totaled the following morning, envelopes and cards go to their respective clerks.

Referring now to Fig. 2, the date, the workman's name and his number are entered by him at the top. The job number or lot number, as it is called above, is obtained by the workman from conspicuous lists of the different jobs in progress with their numbers, which are posted throughout the shop. The "division" line of the card represents what may be called the compound parts of the machine of which it is desired to know the cost. Thus the headstocks of a lot of lathes would form one division, the tailstocks another and so on. The division could, if desired, be extended to each individual piece of the machine, though at a great increase of clerical labor. The actual divisions made represent the extent to which it is considered worth while to subdivide and trace the costs.

After receiving the cards for the previous day, the first duty of the cost clerk is to see that the total hours upon the envelopes are the true sums of the records upon the cards within. He then empties the envelopes, enters the amount of wages earned on each card at the right and then sorts the cards, all cards belonging to a given job number being brought together, and those for each job number being then subdivided into the divisions to which they belong. When this is completed the clerk has a number of piles of cards before him, each one of which represents all the work done the previous day upon a given division of a given lot of machines. Taking the cards of a given division in his hand he rapidly adds the wages from the cards for a given division by means of a comptometer, and enters the result in the proper column of a sheet ruled like Fig. 3, one of which is devoted to each lot number in progress, and of which it keeps a running record. When the lot is finally finished the sum of the figures on its sheet gives the wages paid in doing that piece of work. The sheet shown by its top in Fig. 3 is of good size—10½x14 inches—contains thirteen main columns and is made of light cardboard for durability. In the left-hand column is entered, day by day, the date. Each main column to the right is devoted to a division of the job—this division being written at the top, and the total wages for the day for the division, as summed up on the comptometer, being entered in the proper column. When the amounts for all the divisions worked on during the day have been entered, the total at the right gives the wages paid on all divisions of the lot for the day. At the end of the week a line is ruled across and the totals of each column up to the end of the week show the amounts expended on each division up to that time. The space at the head of the columns just below the heading for the division is for an entry of the total wages for the division of the previous lot of the same machines—this being for comparison as the work goes on. The sheet shown in Fig. 3 is also used as a recapitulation sheet of all the work in progress. For this purpose each column is devoted to a lot number, the total for each lot, for each day, as shown on the right-hand columns of all the lot number sheets being entered in the proper column of the recapitulation sheet, the final total at the right of the recapitulation sheet giving the total wages

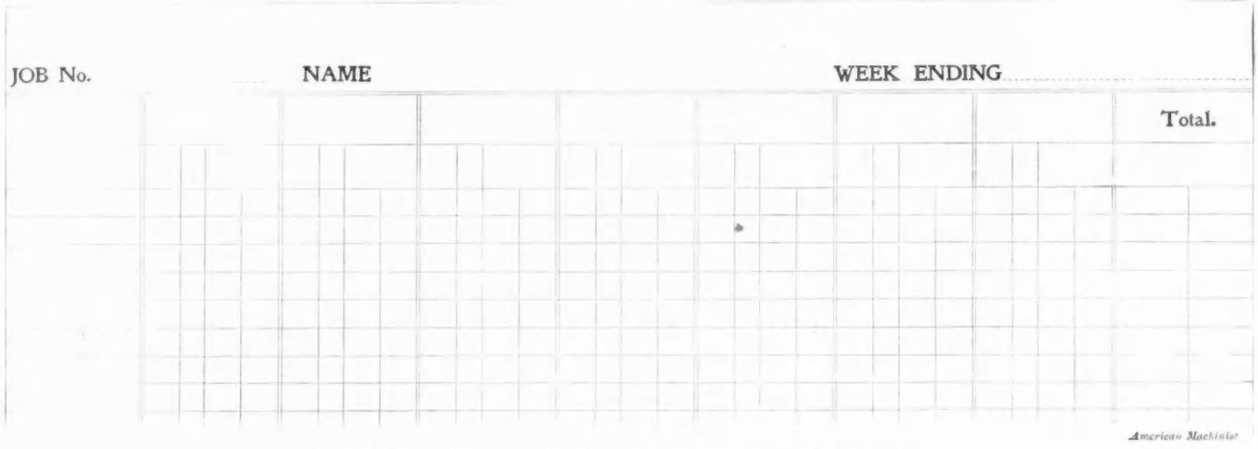

FIG. 3.—WAGES COST SHEET AND RECAPITULATION SHEET.

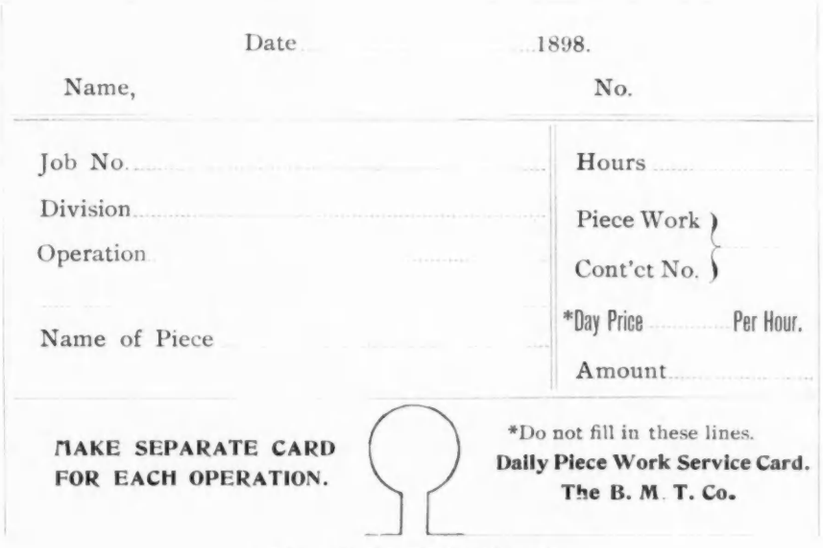

FIG. 4.—PIECE WORK TICKET.

for the day. The correctness of the whole procedure is checked right here by adding up the amounts on the envelopes by the comptometer. The total obtained from the recapitulation sheet is the sum of the amounts charged to all the jobs in progress for the day, while the total

Name ..... No. ..... Con. No. .....

Name of Piece .....

Division ..... Job No. .....

Operation .....

No. Pieces ..... Price ..... Total .....

Commenced ..... Date 1898

Finished ..... O. K.

FIG. 5.—PIECE WORK CONTRACT, FRONT SIDE.

obtained from the envelopes is the sum of the amounts paid to the men for the day, and the two should of course agree. If they do not, the error is searched for until found.

A certain amount of piecework is done at these works, and it is necessary to show how this is made to fit in with what has already been described. The accommodation of the two systems in one cost-keeping plan is a fruitful source of difficulty, and we think the manner in which the two are here carried along side by side will be admired. The workmen who are doing piecework have given them each morning one of the envelopes shown in Fig. 1, but instead of the cards shown in Fig. 2, they take piecework cards, shown in Fig. 4. The piecework card is of a different color from the day-work card, to make it distinct, but otherwise it differs from it only in the right-hand portion, which, as shown, contains blank spaces for the number of the piece price contract and for the workman's daily rate of minimum wages. One of these piecework cards is handed in with the envelope each day as work on the contract progresses, and the wages by the day rate is charged to the job and credited to the man precisely as though the work were being done at the day rate. When the contract is finished the excess of earnings is determined and is again charged to the work and credited to the man as an extra.

The piece price contract is made on a card, of which the front side is shown in Fig. 5 and the rear side in Fig. 6. There are two of these cards, precisely alike, except in color, one being for the workman and the other for the office. The front side of the card is self-explanatory, except for the small heavily ruled square, which is reserved for the previous workman's number, the former earnings on the contract or whatever memoranda of that kind it is desired to make on the card. The rear side provides for a running account of the contract. The workman retains his copy of this card and the cost clerk keeps his before him until the contract is completed. The wages at the day rate are entered upon the back of the contract card as reported day by day on the card shown in Fig. 4, and when the work is done the total amount compared with the contract price on the front side shows the excess due on the contract, which is then credited to the man and charged to the division to which it belongs in the same manner as the daily wages.

As the cards accumulate they are filed in an ordinary card index file, of which a half-tone picture from a photograph is seen in Fig. 7. It will be seen that the drawers are in width double the length of the cards. A half drawer, or whole drawer, or two drawers are devoted to a given lot number according to the needs of the case, the removable labels on the fronts of the drawers showing the lot numbers to which the drawers belong. The division cards, which are wider than, and may be seen standing above the record cards, carry on their projecting edges the names of the various divisions of the lot, the record cards being filed in their proper places, according to the division to which they belong.

A thin, wide rod is attached to each of the buttons seen in front and near the bottoms of the drawers. When these rods are turned vertically the cards may be put in place or removed at pleasure, but when turned horizontally the button-hole at the bottom of each card holds it in place. When the lot of machines is finished, the cards are removed to make place for the next lot. Before being destroyed they are, however, subjected to further study and analysis. It will be seen that while Figs. 2 and 4 have a place for the operation, no record finer than the division was made in the cost sheet, Fig. 3. After the lot of machines is finished the cards are again assorted down to the operations on each division. The cards for a given operation on a division are totalled by the comptometer, and the results are then entered in a book for permanent record. A page of this book is devoted to a lot of machines, the columns being given to the divisions, while in each line is entered the total for an operation. Thus one line will give in each division column the total for the planing of that division, another line the total for the drilling, another the scraping, and so on, the final totals at the foot of each column being the total at the foot of the columns of the cost sheet, Fig. 3, but divided into operations, while the totals at the foot of the columns of Fig. 3 are made up of the amounts per day without regard to the operations.

The record of the materials used is

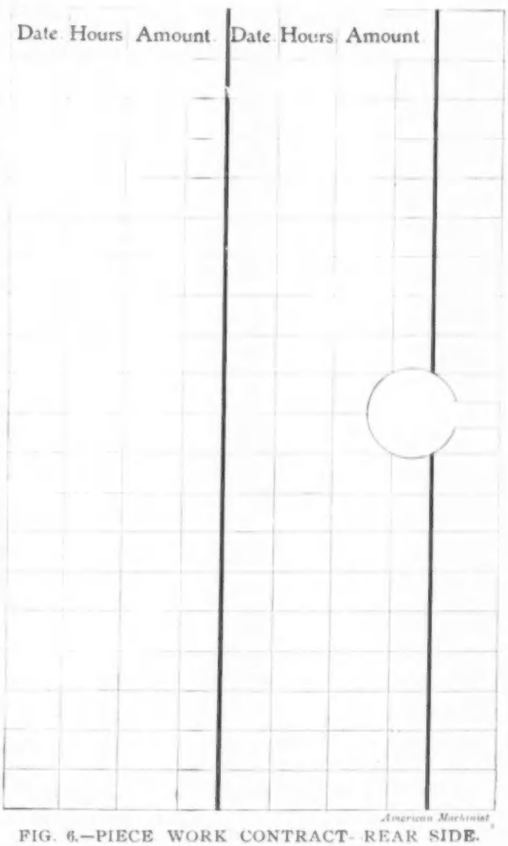

FIG. 6.—PIECE WORK CONTRACT—REAR SIDE.

kept on the blanks shown in Figs. 8 and 9, of which the former is a piece of stout cardboard 9x11 inches, and is confined to

castings, special forgings and other material ordered from outside the works.

The Bullard Works have no foundry, and on starting a lot of machines order the required number of castings and special forgings on a blank order sheet, not here shown. The order is copied in a press copy book, and as the castings are received they are entered on the sheet here shown in Fig. 8, the comparison of this sheet with the copy in the copy book showing when all the required castings have been received. The sheet is then turned in to the cost clerk to be used in making up the total cost when the work is all done and the wages cost sheet is completed. The material sheets for the materially to the ease with which a given sheet can be found.

Bar iron and steel, bolts, nuts, etc., from the stockroom, are kept track of by the small sheet (4x5 inches) shown in Fig. 9. Any material given out of the stockroom has one of these sheets made out for it, when it is at once sent to the cost clerk. The completion of the job sees the labor record sheet, Fig. 3, and the ordered material sheet, Fig. 8, complete in his hands, as well as a number of the sheets from the stockroom, Fig. 9, which together give all the data necessary for finding the total direct outlay for the work.

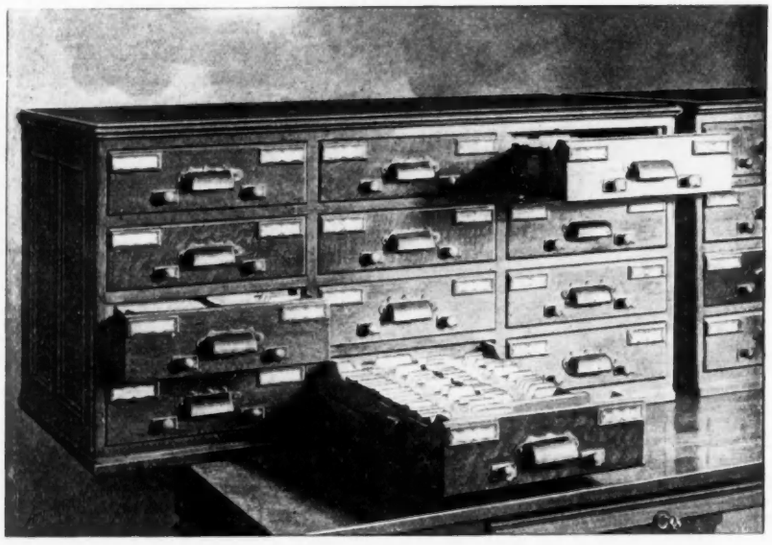

FIG. 7.—CARD INDEX FILING CASE.

The expense charges are calculated at the end of each quarter of the year, and are charged on the wages—not on the time. A good deal has been said in our columns on this subject of late, each method having its advocates. Mr. Bullard considers that as cost is measured in dollars and not in hours it is fundamentally wrong to keep cost records in hours of varying value to be roughly averaged into dollars at the end of a given piece of work. The hours of work are therefore translated into dollars at the very beginning of the cost system—on the day cards as has already been shown—and thereafter the hour is lost sight of. In calculating the expense percentage or "loading," the total expense for the quarter as shown by the ledger is divided by the total amount of wages paid during the quarter. The resulting percentage multiplied by the wages paid out on a given lot of machines gives the expense item for that lot, and the sum of this expense item, the wages paid on the job, as shown on the wages cost sheets, Fig. 3, and the material used as shown by Figs. 8 and 9 gives the final cost.

It is a feature of all cost systems of this kind that they appear far more elaborate and formidable when explained in detail than in actual work. We have used every effort to simplify this description, but we imagine that many of our readers will obtain an exaggerated idea of the intricacies of the method which the facts do not justify. In point of fact, it works smoothly and easily and with no undue amount of clerical labor. Any system, no matter how rough and ready it may be, involves a good deal of work, and the difference in that respect between a poor and a good system is small. The Bullard Works have developed this method after enough experience with imperfect methods to be able to justly compare the two, and their conclusion is that the new method is abundantly justified by the results obtained.

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There has been established in the Monadnock Block, Chicago, the "Railway News Bureau," the special mission of which seems to be to furnish to newspapers ready-made items of news about railroads, all of which items are, of course, favorable to the roads and calculated to show what valuable service they render and how little they are paid for it. It is special pleading, of course, but it may do much to make many people believe the financial and political management of the roads is not so bad as it is painted.

"BORING AND TURNING MILLS.

JOB No. MATERIAL.

DATE	ORDER No.	PATTERN No.	No. Pcs.	NAME OF PIECE	WANTED	RECEIVED	WEIGHT	

FIG. 8.—MATERIAL SHEET FOR ORDERED MATERIAL.

two main lines of work—boring mills and turret lathes—are kept separate, by the former having its heading at the left of the sheet, while the latter has its heading at the right. A third sheet, used for miscellaneous work, has a place for its heading in the middle of the top, the space being, however, left blank, to be filled with the pen. With a quantity of such sheets in a pile this arrangement adds

An Adjustable Boring Tool.

The cut shows a boring tool made and used by Mr. T. R. Almond, of Brooklyn, N. Y. Its construction is sufficiently shown without explanation, but it may be well for us to call attention to the principal features of the tool. It is used for roughing or heavy boring as well as for finishing the hole, the means provided for minutely adjusting the diameter of the cutters being an important advantage where accuracy is required. The main central piece, or stock, of the tool has a taper shank, fitted to the spindle of a lathe or drill, and the work is assumed to be fastened firmly to the lathe carriage or drill table. The tool as shown here bores a hole 3 inches in diameter, and the shank is 1½ inches diameter, the cutters being made of three-quarter inch square steel. The shank is not flatted, as has usually been thought necessary, but the cutters are planed or milled out to the circle of the shank, the single fillister head screw and the two dowel pins being sufficient to locate the cutters precisely and to hold them firmly. The head of the screw is sunk into one cutter enough to clear the bore, while the hole in the opposite cutter is tapped for the end of the screw. A hole about seven-sixteenths inch diameter is drilled into the shank lengthwise a sufficient depth, and the outer end of the hole is tapped with a one-quarter inch pipe tap. A cross slit is sawed in the stock some distance beyond the length of the cutters, and a pipe plug in the end of the hole spreads the cutters as it is screwed in. The tension of the cross screw is always such as to hold the cutters and the adjusting plug securely. The adjustment for diameter is preferably done with the tool in place in the lathe or drill, or otherwise held rigidly, and with a right-angled screwdriver, having a shank of considerable length and perfectly fitting the slot in the plug. The cutters are quickly changed, the same shank being used for both the roughing and finishing of the hole, if desirable to do so.

The International American Bank.

Among the measures that will come up for consideration at the next session of Congress is one that is of great importance to exporters, for it will have an important bearing on the expansion of our export trade. The measure in question is the proposition to incorporate an international American bank for the purpose of promoting export trade. A bill with this object in view was introduced at the last session of Congress and passed the Senate, but failed to pass the House, being crowded out by several other important measures. It has, however, been made a special order for the next session, when it will be brought up.

The bill is in accordance with the recommendation of the Pan-American Congress, and is designed to furnish such banking and exchange facilities as will promote trade between the United States and the countries of Central and South America. The bill provides that the bank shall have a capital stock of $5,000,000, and that the capital stock may be increased to $25,000,000. The institution, in accordance with the terms of the bill, shall be under the supervision of the Comptroller of the Currency, and in the charter of the corporation, which the bill grants, certain privileges are accorded to the incorporators in view of advantages which are expected to accrue to those interested in trade with South American countries. Among those interested in the proposed corporation are such well-known business men as P. D. Armour, Andrew Carnegie, Enoch Pratt, Charles R. Flint and C. N. Bliss, Secretary of the Interior.

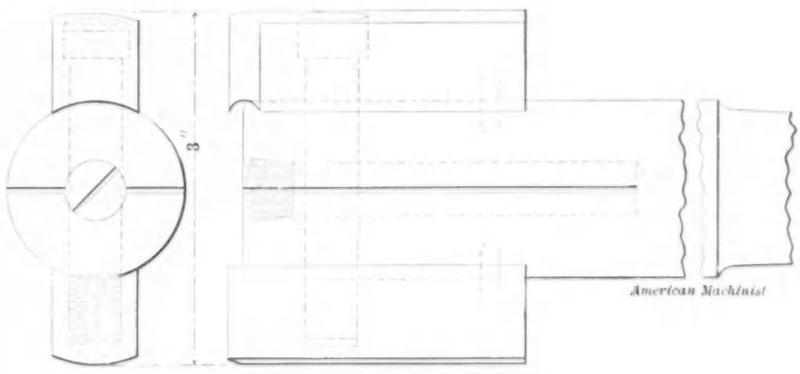
The people of the United States, in common with those of the Central and South American republics, feel the importance of increasing commercial intercourse between the different portions of the American continent, and they believe the development of such intercourse has been retarded by the lack of adequate facilities for exchange between the several countries, and their hope for a revival in trade is based upon the establishment of improved banking facilities, which will place our merchants on a more favorable footing. No one has expressed the situation more tersely or more forcibly than Theodore C. Search, president of the National Association of Manufacturers, after a tour of observation through South America. He says: "As in our ocean commerce, so also in our financial relations with other countries, we are dependent largely upon the services rendered by foreign interests. Particularly in our dealings with the nations to the south of us we are in urgent need of direct international banking facilities. We do $150,000,000 worth of business with South America in a year, and yet all our balances have to be settled through English or European banking houses. In the great trade centers of South America the English, the Germans, the French and the Italians have their banks, but I think I am right in saying that there is not an American bank in all South America. Manifestly this is a serious hindrance to our trade."

The financial part of all our business with South America is carried on through Europe. European vessels carry the goods, Europe receives the commissions and freights, and sells most of the goods consumed in South America, while

STOCK LIST.

Job Number.		Weight.	Material.

FIG. 9.—MATERIAL SHEET FOR MATERIAL FROM STOCK ROOM.



EXPANDING BORING TOOL.

the United States is the largest purchaser. This condition of the trade is due to five facts, namely: First, we have no banks in South America—Europe has them everywhere; second, we run few steamships to South America—Europe runs them to all her ports; third, we have no United States stores in South America—Europe has her stores in all parts of that continent; fourth, we sell for cash—Europe gives credit; fifth, Europe makes goods and packs them to suit the South American trade—we do not.

Without underestimating the importance of the other facts named, it is quite obvious that the first one is at this time pressing with great urgency upon the attention of the American manufacturers in connection with the universal desire to increase our commerce with our southern neighbors.

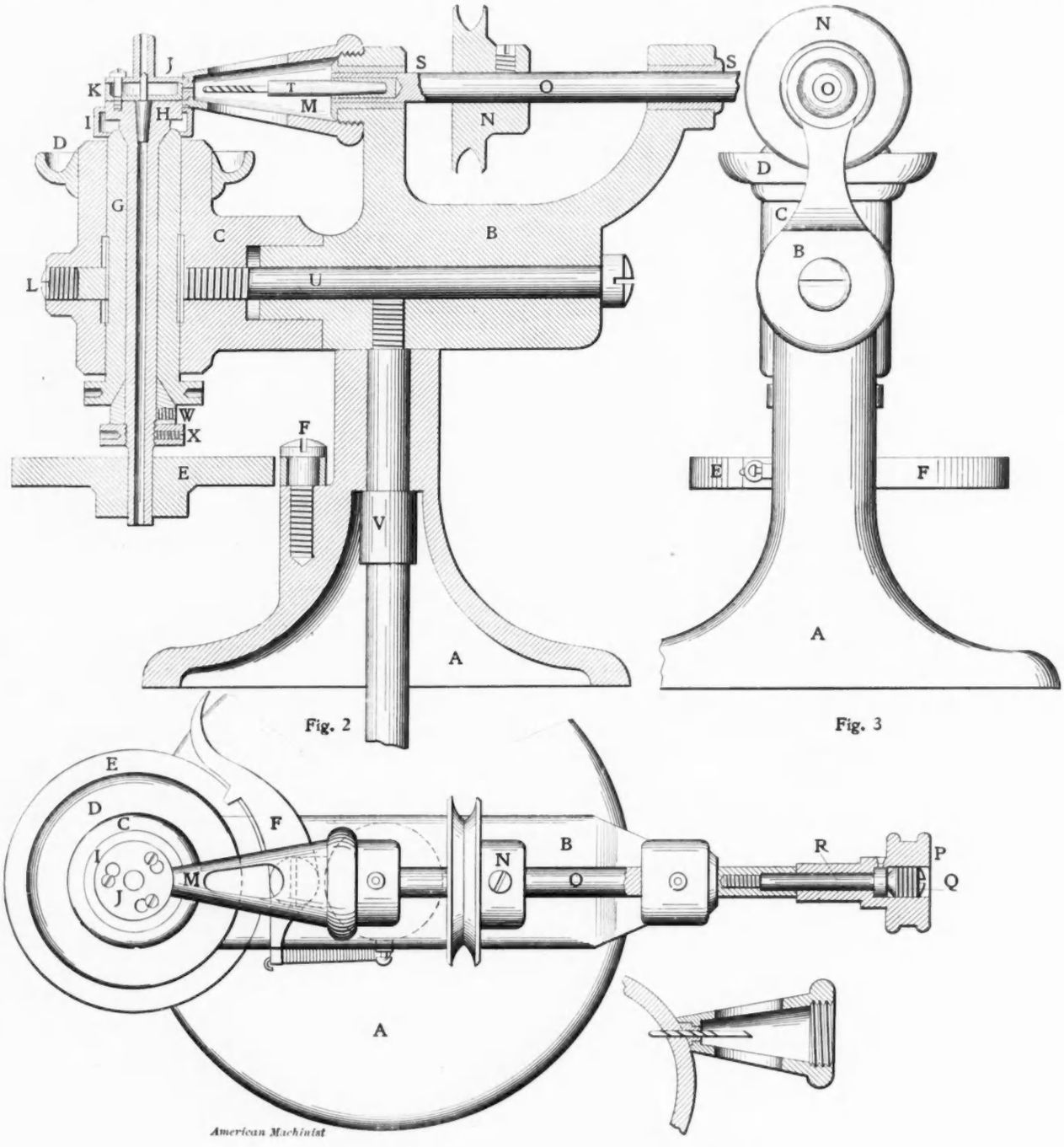


Fig. 1

Fig. 2

Fig. 3

Fig. 4

DRILLING MACHINE FOR WATCH BALANCE WHEELS.

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Special Drilling Tools.

BY A. H. CLEAVES.

At Figs. 1, 2 and 3 I have shown a special lathe for drilling balances for watches, the holes in the rim for the screws being at irregular distances. The advantage of a tool like this for this class of work, for whatever purpose, can be seen readily, I think.

A is the base or pedestal and *V* the bench-bolt, with a projection cast on *A* for the pawl *F*. The index-plate *E* is shown with but one notch for convenience.

A part of the body of the tool *B* carries the drill spindle and another part *C* carries the work fixture; the two parts held together by the bolt-screw *U*.

W is the usual angle bearing, with

square tipped screw sliding in a slot in the spindle *H* and revolving with the latter. *X* is a check nut for this collar, but, instead of being held with a screw as shown, it is made in practice with the rim sawed and compressed to prevent moving on *H*.

This spindle carries the balance *K* centered by the pin in *H* and clamped with

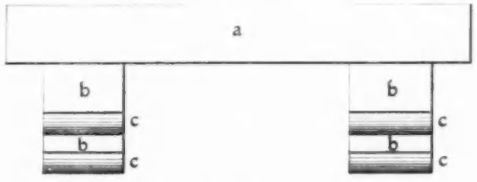


Fig. 5

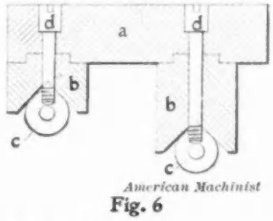


Fig. 6

JIG FOR DRILLING WIDELY SEPARATED HOLES.

J Three holes in the latter (see Fig. 1) admit the binding screws, and slots for the screws run from these holes. *I* is a dust guard; *D* is an oil cup. The balance rim in which the holes are drilled, being brass and steel combined, requires lubricating.

The spindle and bearings in this piece being turned slowly by hand are not necessarily hardened. A bearing like *G* is common in watch machinery for adjusting purposes. This is shown at *L*, where a set-screw binds a brass seat against the sleeve *G* at the threaded part. When this is loose the work *K* can be raised or lowered by turning *G* at the pin-holes in the lower part of same.

The special feature of this lathe is shown at *M*, where a long nose-piece or drill guide is projected from the piece *B* steering the drill *T* at the very point of contact, answering for a dozen holes as well as for one. This shell or guide piece is stationary, with opening in top and bottom for clearance, oiling drill, etc. *G* is drill spindle, *N* pulley, and *SS* hard bearings.

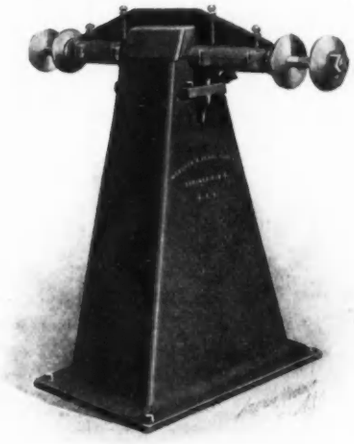
In Fig. 1 *P Q R* give an idea of a good handle for a fast running spindle. The thrust being at the hardened contact between *Q* and *R*, the latter also being the place of adjustment for end-shake. The screw *Q* has a set screw in *P*, not shown.

Fig. 4 shows drilling out of line with the radius at the rim, the guide-piece here as before having a hardened bushing for the drill.

Figs. 5 and 6 illustrate a method of drilling widely separated holes for parallel rods for hinges in frames, etc. Pieces like *b* cut from strips planed to right dimensions are held parallel in the plate *a* by means of grooves. Holes are then bored by the use of bushings of equal diameter in the same grooves, but made of right diameter to get proper distance from *a*. This kind of a jig can be dropped down into work close to frame supports, etc., to be drilled, and avoid interference.

For a drill in this kind of work, where length is required, the best way to get one is to make it, by flattening a piece of drill rod and twisting the flat part while hot.

Hold the point in the bench vise and the rod in a hand vise, and twist to taste by heating hottest where twist is wanted. A movable Bunsen blast burner is best for such work; or a lamp and blow-pipe for small stuff, as the work can be heated while in the vise. The twist-drill end can be brought down to size of the rod by being drawn backward through a hollow mill. Then back off



IMPROVED GRINDING AND POLISHING FRAME.

the cutting lips to prevent dulling and binding. Screws *d* can hold *a*, *b*, *c*, or *c* can be held to *b* and *b* to *a* by separate screws.

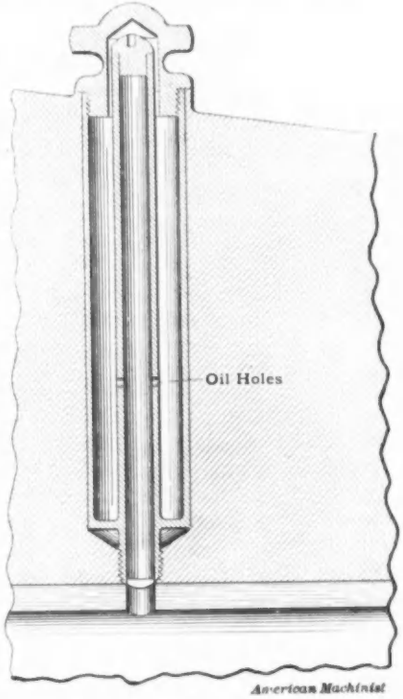
Chicago, Ill.

▲ ▲ ▲

A New Grinding and Polishing Frame.

We illustrate a new buffing and polishing "lathe" which has some interesting features. The machine, as shown, has tight and loose pulleys on the center of the arbor and is belted from below. It may be driven from above by removing the inclined, flat plates, one of which is shown in front, a similar one being located at the back. One holder for the sliding shipper rod is seen projecting backward under the horizontal main bearing. The belting from below is rather desirable than otherwise with this type of machine, as the work is usually placed under the wheels, and in operation there is a tendency to lift them. Everything is also thus securely inclosed from the dust and lint of the wheels.

A special oiling device used on this machine is shown in Fig. 2. It is a trap which provides for the deposition of any grit or heavy foreign matter that may get into the oil, and is at the same time entirely removable for examination or cleaning. A boss is cast on the top where each oil cup is to be, and the large hole is drilled to the proper depth with the small tapped hole at the bottom. The stem of the oil cup screws into this hole, the large outer tube fitting the large hole in the casting. There is a small central tube in the oil cup with two or three small holes at about one-third of its hight. The oil is contained in the space around the central tube and passes by the small holes to the inside of the tube and down to the bearing. The space around the central tube is the oil reservoir, that portion of it below the small holes allowing for the settling of the fine emery or other foreign matter. The screwdriver plug at the top is soldered into the tube and is used for screwing the oil cup into place or for removing it. The large cap is removable by hand when oil is to be supplied.



OILING ARRANGEMENT OF GRINDING AND POLISHING FRAME.

The bearings of the machine are 1¾ inches diameter and 14¾ inches long, giving large bearing and wearing surface. The frame is necessarily stiff and solid. The loose pulley has a phosphor bronze bushing, with an oil recess large enough to allow it to run a week before refilling. The machine is made by Webster & Perks, Springfield, Ohio.

The Influence of Bismuth on Brass and Its Relation to Fire-Cracks.

BY ERWIN S. SPERRY, BRIDGEPORT, CONN.*

It is a tradition in the brass industry that bismuth is an injurious element in brass, even more deleterious than antimony; but such a belief has lacked verification. The occasional presence of bismuth in commercial copper (although less frequent than was formerly supposed) led the author to investigate this tradition.

FIG. 1.—BRASS CONTAINING 0.50 PER CENT. OF BISMUTH, WHICH FIRE-CRACKED DURING ANNEALING.

The following experiments were conducted in the same manner as those described in a previous paper on "The Influence of Antimony on Brass," to which the reader is referred for details. The purest Lake Superior copper was used, and after it had been melted the bismuth was introduced as an alloy of copper and bismuth. Zinc in the form of pure refined metal was next added, and the mixture was stirred and poured into an iron mold 5⅝x2⅜x24 inches. All rolling was performed cold. For reasons previously mentioned, a base alloy was used, consisting of copper 60 per cent. and zinc 40 per cent.

Experiment No. 1.—Copper, 59.50; zinc, 40; bismuth, 0.50 per cent. Melted 5.5 pounds of copper, added 0.5 pound of an alloy of copper 90 and bismuth 10 per cent., and then 4 pounds of zinc. Rolled from 0.595 to 0.472 inch, a reduction of 20 per cent. Cracked badly on one edge, but otherwise the surface appeared unchanged. Annealed, and the plate fire-cracked on both sides. While many of the cracks were merely superficial, others penetrated the metal so deeply that further rolling became impossible. The fire-cracked plate is reproduced in Fig. 1.

* Prepared for the October meeting of the American Institute of Mining Engineers.

While this alloy is cold-short, it is less so than the corresponding antimony alloy. The fracture is finely crystalline, as shown in Fig. 2.

Experiment No. 2.—Copper, 59.69; zinc, 40.06; bismuth, 0.25 per cent. Melted 5 pounds 6 ounces of copper, added 3.75 ounces of an alloy of copper 90 and bismuth 10 per cent., and then 3.75 pounds of zinc. Rolled from 0.655 to 0.495 inch, a reduction of 24 per cent. Cracked slightly on the edges, and a few checks appeared on the surface. Annealed, and fire-cracks formed on both sides of the plate. These cracks were quite numerous, but did not penetrate the metal as deeply as those in Experiment No. 1. Rolled from 0.495 to 0.416 inch, a reduction of 15 per cent., and the fire-cracks became greatly enlarged; many others also appeared. The latter were apparently *latent* fire-cracks, as the plate did not show any additional cracks on the edges. Such latent fire-cracks were noticed in succeeding experiments, and are evidently due to the presence of bismuth, as the reduction in rolling was not sufficient to cause them. Rolled still further to 0.355 inch, a reduction of 29 per cent., and the plate cracked to pieces. The edge-cracks first formed did not increase in size perceptibly.

The following test was made on a rod (not annealed after being turned) cut from an ingot which was cast at the same time as the plate. The results show that the cause of the cracks was not insufficient elongation.

Length, 12 inches; diameter, 0.270 inch; sectional area, 0.0572 square inch; breaking strain, 2,560 pounds, or 44,700 pounds per square inch; elongation in 1 inch, 40 per cent.; in 6 inches, 27 per cent.; diameter of fracture, 0.205 inch; reduction of area, 42.3 per cent.

The cold-fracture of this alloy is finely crystalline, and the appearance so similar to that of the alloy containing 0.50 per cent. of bismuth that it is deemed unnecessary to show a reproduction.

Experiment No. 3.—Copper, 60.01; zinc, 39.90; bismuth, 0.09 per cent. Melted 5 pounds of copper, added 1 1-3 ounces of an alloy of copper 90 and bismuth 10 per cent., and then 3 pounds 6 ounces of zinc. Rolled from 0.660 to 0.485 inch, a reduction of 26 per cent. No cracks appeared during this reduction. Annealed, and the surface of the plate presented an unchanged appearance; no traces of fire-cracks were visible. Rolled to 0.420 inch, a reduction of 13 per cent., and an enormous number of fire-cracks appeared on both sides of the plate. No edge-cracks formed during this reduction. The cracks which were produced during the latter reduction were evidently of a latent nature, like those in Experiment No. 2. They penetrated the plate so deeply that further rolling was impossible.

FIG. 2.—BRASS CONTAINING 0.50 PER CENT. OF BISMUTH. COLD FRACTURE, MAGNIFIED TWO DIAMETERS.

The cold fracture of this alloy is finely crystalline, and is reproduced in Fig. 3.

Experiment No. 4.—Copper, 59.95; zinc, 40; bismuth, 0.05 per cent. Melted 5.5 pounds of copper, added 0.5 pound of an alloy of copper 99 and bismuth 1 per cent., and then 4 pounds of zinc. Rolled from 0.594 to 0.420 inch, a reduction of 29 per cent. No cracks appeared. Annealed, and rolled to 0.319 inch, a reduction of 24 per cent. A few slight edge-cracks formed during this reduction, but otherwise the sheet remained unchanged. Annealed, and fire-cracks appeared on both sides of the sheet. Many of the cracks were so deep that the plate could not be rolled again. Rolled another portion from 0.420 to 0.371 inch, a reduction of 11 per cent., and then annealed. No fire-cracks could be seen. Rolled to 0.325 inch, a reduction of 12 per cent., and *latent* fire-cracks appeared in large numbers. The position of these cracks was different from those on the other plates; many were transverse, others diagonal, and others longitudinal. Rolled without annealing to 0.189 inch, a reduction of 41 per cent. No edge-cracks formed, and the fire-cracks seemed to have become obliterated, which gave the sheet* the appearance of perfect homogeneity. Rolled the sheet still further to 0.058 inch, a total reduction of 84 per cent., and it cracked so badly on the edges that additional reduction was almost impossible.

By an examination of the fracture of this alloy, shown in Fig. 4, one can readily see that crystallization has nearly disappeared.

Experiment No. 5.—Copper, 59.98; zinc, 40; bismuth, 0.02 per cent. Melted 5 pounds and 12.75 ounces of copper, added 3.25 ounces of an alloy of copper 99 and bismuth 1 per cent., and then 4 pounds of zinc. Rolled from 0.590 to 0.504 inch, a reduction of 14 per cent. Did not crack on the edges. Annealed, and rolled to 0.384 inch, a reduction of 23 per cent. Neither edge-cracks nor latent fire-cracks appeared. Annealed, and rolled to 0.052 inch, a reduction of 86 per cent. At the thickness of 0.125 inch slight cracks began to appear on the edges, and at 0.052 the reduction had reached the maximum amount. No fire-cracks were detected during the rolling process. This alloy seemed to roll nearly as well as brass free from bismuth; therefore, 0.02 per cent. of bismuth represents the dividing line between satisfactory and unsatisfactory brass.

FIG. 3.—BRASS CONTAINING 0.09 PER CENT. OF BISMUTH. COLD FRACTURE. MAGNIFIED TWO DIAMETERS.

The following tests were made on sheet rolled from 0.384 to 0.053 inch, a reduction of 86 per cent.:

	As Rolled.	Annealed.
Size	0.482x0.0585 in.	0.475x0.0585 in.
Length	12 in.	12 in.
Sect. area	0.0257 sq. in.	0.0254 sq. in.
Breaking strain.	2816 lbs.	1,510 lbs.
Breaking strain per sq. in.	109,000 lbs.	59,000 lbs.
Elong. in 1 in.	4 per cent.	47 per cent.
Elong. in 8 in.	1 per cent.	37 per cent.
Size of fracture.	0.474x0.0515 in.	0.365x0.039 in.
Reduct'n of area	5 per cent.	44 per cent.

The fracture of this alloy shows no traces of crystallization, and compares favorably with that of brass free from bismuth or other injurious elements. The comparison of the results obtained by rolling this alloy, with those obtained on pure brass of the same composition, shows that practically the same reductions can be given. The fracture is reproduced in Fig. 5.

Conclusions.—While it has been known for some time that bismuth is an injurious impurity in brass, the author believes it has not been demonstrated before that this element is a cause of fire-cracks. The reason for this phenomenon is not well understood, but there is evidently a segregation of bismuth or an alloy of bismuth which is devoid of sufficient strength to stand the necessary strain.

The results obtained by Stead, in his researches on the microscopic examinations of alloys, throws some light on the subject. By the examination of an alloy of copper 99 and bismuth 1 per cent. he found that a segregation takes place, and that if such an alloy is bent fracture will take place along the lines of this segregation. It is reasonable to assume that the action of bismuth on brass is similar.

It must not be supposed that all fire-cracks in brass are due to bismuth. As a matter of fact, it is very doubtful whether this element is usually the cause of such trouble; in the majority of instances the amount of bismuth in copper

FIG. 4.—BRASS CONTAINING 0.05 PER CENT. OF BISMUTH. COLD FRACTURE, MAGNIFIED TWO DIAMETERS.

* When such sheet is rolled, cracks of this nature either close so as to become invisible to the naked eye or form slivers, by the edges of the cracks overlapping one another and then becoming rolled down. The invisible cracks do not weld together; and while, under ordinary conditions, they are difficult to detect, they are readily made apparent by polishing the sheet.

is not large enough to interfere with its employment in the manufacture of brass.

The behavior of these alloys when forged hot is worthy of notice. The alloy containing 0.50 per cent. of bismuth could not be forged at any heat. The 0.25 per cent. alloy behaved in a similar manner. The alloy containing 0.09 per cent. of bismuth would forge to a thin edge, but alloy would forge to a thin edge and bend The 0.05 per cent. alloy likewise fractured at the bend. The 0.02 per cent. alloy would forge to a thin end and bend over on itself, showing but few cracks, but did not behave as well in this respect as brass containing no bismuth.

The results obtained in the preceding experiments are collated in the following summary:

1. Bismuth renders brass cold-short, and is similar in this respect to antimony, although the effect is not so marked.

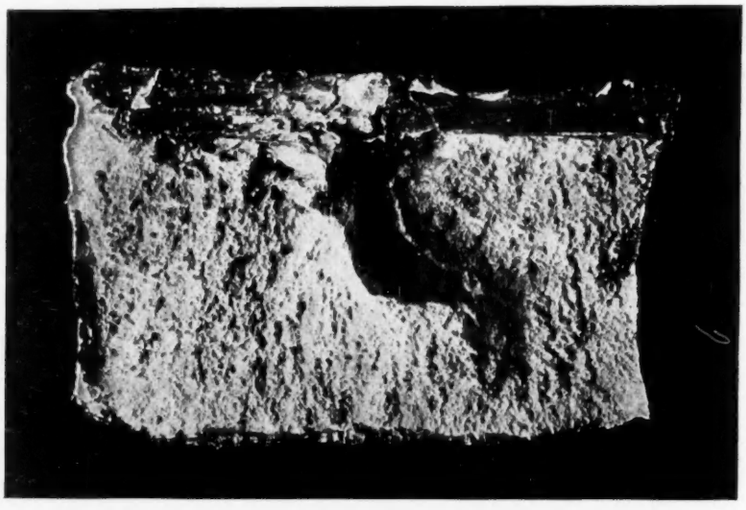


FIG. 5.—BRASS CONTAINING 0.02 PER CENT. OF BISMUTH. COLD FRACTURE, MAGNIFIED TWO DIAMETERS

2. Bismuth is a cause of fire-cracks in brass.

3. High brass intended for cold-rolling should not contain over 0.01 per cent. of bismuth.

4. Bismuth produces hot-shortness in brass.

5. Bismuth is a cause of *latent* fire-cracks in brass.

In the use of the term *latent* in connection with fire-cracks it is the author's belief that while annealing is the cause of their existence, they do not exist as cracks in the metal after annealing, but as lines of inferior cohesion in an apparently homogeneous mass; rolling, however, develops them, and to all appearances they then partake of every characteristic of true fire-cracks. It seems advisable therefore, to apply such a distinguishing term, especially as *latent* fire-cracks are liable to be mistaken for *rolling*-cracks.

▲ ▲ ▲

Some of the street car lines tributary to the main lines in New York are to be operated by compressed air.

Letters from Practical Men.

A Study of Horse-Powers.

Editor American Machinist:

In your issue of August 4 I notice a letter by Mr. Tecumseh Swift entitled "Trouble With the Horse-Power."

While it is true that Watt made an effort to represent approximately the amount of work a horse could accomplish per minute, it can be readily shown that the number (33,000 foot pounds) is much too low to represent the work an average horse can do in a single minute, and considerably too high to represent the work he can do per average minute in a day of ten or even of eight hours, or, in other words, the number (33,000 foot pounds per minute) is very much below his capability for a single minute and considerably above his capability for a day of eight or ten hours. This latter statement is especially true if he performs the work at considerable speed, say of 8 or 10 miles per hour. A well trained horse can for a few seconds exert as much as 200,000 foot pounds per minute, or about six times the power represented by Watt's standard. If we attempt to replace the horse by a mechanical motor we must first ascertain the maximum power to be exerted and provide for it. Sometimes mere strain at slow speed will answer in the place of the same strain at high speed. In this case it may not be necessary to increase the power to meet the emergency, but simply to decrease the speed. Many persons who have attempted to replace the horse-drawn vehicle on the highway by a mechanical carriage have greatly underestimated the flexibility of power possessed by the horse. The horse is not entitled to any credit on account of propelling himself. This he must do in effect no matter how he works in order to exert his power. When he draws a load over the road at moderate speed he is at no more disadvantage than when operating stationary machinery, as he must walk and draw his load in either case in order to exert his power. Not so with the mechanical motor. If it is applied to the propulsion of stationary machinery it does not convey itself over the ground either in effect or actually. The question of internal friction does not enter into the problem at all either in the case of the horse or in the case of the mechanical motor. No competent person would think of taking the indicated horse-power of a steam engine or gas engine as a basis for driving machinery of known resistance, except as a means of determining the actual or brake horse-power. Likewise with the horse. We are not concerned practically with the power he may generate in his internal mechanism, but with the portion of his power that is practically available. If we place the mechanical motor on the road and compel it to convey itself as well as a vehicle upon which it rides, together with the load of passengers or merchandise, supplies for the motor, etc., we have placed the motor at some disadvantage from what it would suffer when running stationary. The amount of this disadvantage is measured by the extra power required to carry the motor and its supplies, together with the extra weight required in the vehicle in order to enable it to carry the increased load. This disadvantage would of course vary with the kind of motor and the length of time the supplies were supposed to last.

Let us take the gasolene motor for comparison, as this form, all things considered, has shown the highest efficiency. Let us assume that supplies may be taken as often as a horse is fed, say once in five hours. The conditions would then be about as follows for a vehicle capable of carrying, say, two persons and supplied with a one horse-power balanced motor:

Weight of 1 horse power balanced motor..lbs.		125
" water for 5 hours' run.....	"	25
" battery	"	30
" gasolene for 5 hours' run.....	"	4
" driving gear.....	"	30
Extra weight of carriage.....	"	100
		314

Total disadvantage of traction motor as compared with stationary motor equals the amount of power required to carry 314 pounds over highway.

The weight of an ordinary horse carriage as commonly constructed is about 300 pounds. Adding to this the weight of two passengers, say 300 pounds, we have the total weight to be conveyed by the horse as 600 pounds.

The total weight conveyed by the motor is the sum of 314, 300 and 300, or 914 pounds.

Now, assuming that it requires about two-thirds of a horse-power (two-thirds

of 33,000 foot pounds per minute) to convey the motor wagon and load at the rate of 5 miles per hour over a given road, then the horse-power required to convey the loaded horse carriage over the same road would be two-thirds of two-thirds, or four-ninths horse-power, assuming that the power required is directly proportional to the load, which is approximately true. Now let us suppose the roadway to be improved to such a degree that the power expended in each of the above cases would produce a speed of 7 miles per hour. We now see that the average horse would be unable to perform continuously the work required on account of the fast speed demanded. The motor, on the other hand, could keep the 7 mile pace on the good road just as easily as it could the 5 mile pace on the inferior road. We therefore find that the horse is decidedly inferior to the one horse-power motor provided the road is sufficiently good and practically level, and the distance traveled sufficiently great.

If, on the contrary, the road is hilly, and in places bad, so that increased resistance is offered to travel, the horse, by reason of the flexibility of his power, can readily overcome all ordinary difficulties and travel at nearly the same speed (provided the bad road does not extend too far) as he traveled on the good road, while the motor wagon, in order to traverse these difficult places, must be provided with gearing which will enable it to drive the carriage at a very slow rate of speed. Otherwise it will stop and utterly fail to move the carriage. This flexibility of power is possessed in some degree by all animals. It is not generally known that an average man can exert 550 foot pounds, or more, per second for a few seconds. Any able bodied person may demonstrate this to his own satisfaction by taking a stop-watch in his hand and running up a stairway at full speed, taking care to start the watch just as his foot leaves the floor and stopping it the instant he reaches the landing. A simple calculation will give the number of horse-power. Thus:

$$P = \frac{w \times h}{550 \times t}$$

in which w equals the weight of the person, h the vertical hight of the stairway, t the time of ascent in seconds, P the number of horse-power exerted. An average man will readily exert from 1 to 1¼ horse-power under these conditions.

The failure to recognize the flexibility of animal power has led to many ridiculous mistakes and absurd conclusions. These mistakes have not only been of frequent occurrence among persons attempting to build motor carriages, but have led to much useless expenditure of time and money.

ELWOOD HAYNES.

Kokomo, Ind.

Universally Incorrect Indicator Practice.

Editor American Machinist:

It is high time that somebody should get up and say something about our way of using indicator diagrams. I mean the practice, practically universal, of taking the single indicator diagram to represent the single stroke of the engine, instead of representing, as it does, only one-half of the operation for each half stroke. Not one in a hundred of either practical engineers or of college professors correctly compute from the indicator diagrams the distribution of the power developed. If there are a stray 1 per cent. who do otherwise I do not know where to look for them. None of the various books on the indicator, as far as I know, has shown the correct way of getting the actual effective or net pressure acting to drive the piston at all points of the stroke, although the diagram can readily be made to do so.

A single diagram from one end of the cylinder does not convey the information desired, and it is impossible of extraction from it; but the familiar superimposed diagram, taken simultaneously from both ends of the cylinder, always has it, and yet we get practically no more from the double diagram than from the single one, except that we then get the difference in mean effective pressures for the two ends of the stroke, and we invariably get that wrong, unless it happens to be equal for the two ends. We not only actually get this wrong, but from the habit of regarding each single card from each end of the cylinder as complete in itself we get false and misleading habits of thought as to steam action and the pressure distribution.

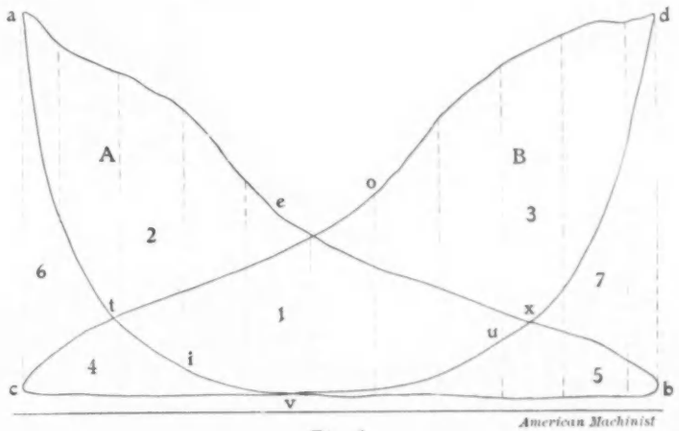


Fig. 1

A COMMON LOCOMOTIVE DIAGRAM.

Any pair of indicator diagrams in which the work for the two ends of the stroke is not precisely alike will serve to show the errors to which the practice leads. Fig. 1 is from "Hemenway's Indicator Practice," with added marks of reference. The twin diagram shown, scale 50, is from a freight locomotive, with cylinders 18 by 24 inches, and making 187 revolutions per minute. The m. e. p. for A, as usually computed, measuring the entire inclosed area of the diagram for that end of the cylinder, is 40.93 pounds, and for B it is 46.05, the ratio of A to B being therefore .8888.

It is not disputed that the mean of these two diagrams, which is 43.49, multiplied by the piston area and travel and

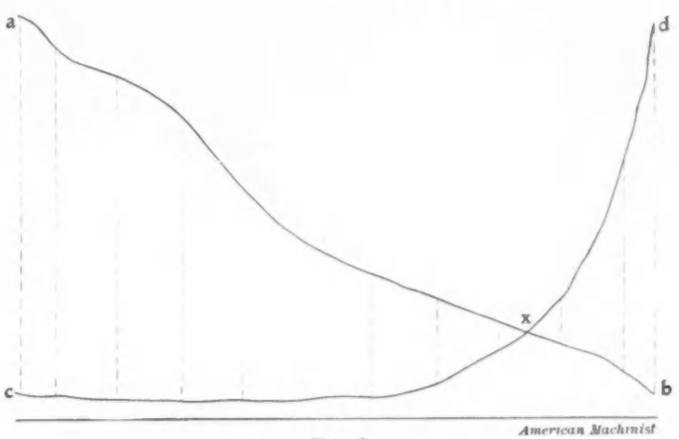


Fig. 2

TRUE DIAGRAM FOR ONE STROKE.

divided by the constant 33,000, will give the correct total indicated horse-power, or, more correctly, when the piston rod is taken into account, the sum of the two, worked up separately, will give the total horse-power; but they do not give the correct amount of work for each alternate stroke, and they do not correctly represent the distribution of the effective force throughout the stroke, the error in each particular being generally important and always misleading.

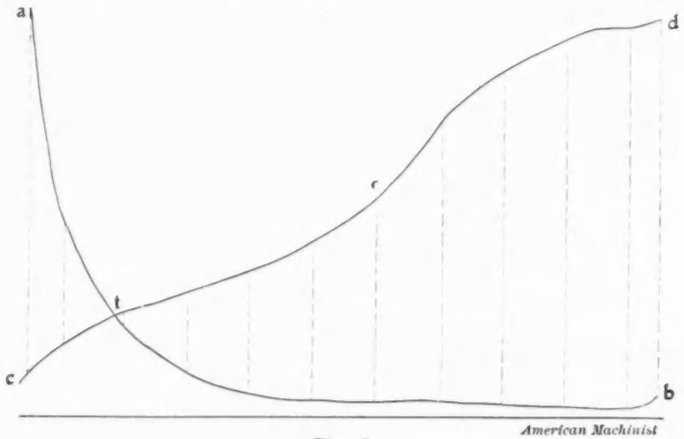


Fig. 3

TRUE DIAGRAM FOR THE OTHER STROKE.

Referring now to Fig. 1 the line *a e b* is all that is necessary to show the steam pressure against one side of the piston for any point of the stroke, and that is all that diagram *A* is capable of telling us about that stroke, the return line *a i b* having nothing whatever to do with the stroke represented by *a e b*. The pressure against the driving face of the piston at any point of the advancing stroke is measured by a vertical line from the corresponding point on the line *a e b* down to the atmosphere line, and the mean pressure against the driving face of the piston is measured by the mean vertical hight of *a e b*, or the mean of any number of equally distributed vertical ordinates. The pressure against the other side of the piston, for the same stroke, or the counter pressure, is indicated by the line *c u d* of diagram *B*, and this pressure is measured by verticals from this line to the atmosphere line. The true and entire diagram for this stroke, if separated from the other, is shown in Fig. 2. This diagram consists of two separate areas, *a x c* and *d x b*, the mean effective pressure being represented by $(a\ x\ c) - (d\ x\ b)$. So in Fig. 3, for the other stroke, the mean effective pressure is indicated by $(d\ t\ b) - (a\ t\ c)$. The m. e. p. of *A*, Fig. 2, is 37.35 pounds, and for *B*, Fig. 3, it is 49.675 pounds, the ratio being in this case .7518, instead of .8888 as in the common and incorrect use of the diagram, as previously computed. The difference in m. e. p. between the two ends of the stroke was by the customary practice 5.12 pounds, while by the correct practice it is 12,325 pounds, or considerably more than double, showing very clearly the possibility of misleading deductions from the established practice.

From the preceding the mean of the two strokes is, by the usual way, 43.49 pounds, and by the correct way it is 43.51 pounds, or they are practically the same, and it is easy to show that they must be identical. The entire twin diagram, Fig. 1, is naturally divisible into seven distinct areas, which are here each numbered for distinction. By the usual mode of procedure card *A* for one end of the cylinder is composed of $1 + 2 + 5$, while card *B* is composed of $1 + 3 + 4$. By the correct mode of computation card *A* should be $1 + 2 + 6 + 4 - 7$, and card *B* should be $1 + 3 + 7 + 5 - 6$. Here, as 6 and 7 are used both positively and negatively, they do not add to the total area included in the ultimate measurement, but by this same alternate positive and negative function they have a double value as bearing upon the relative computed areas for the two strokes. The operation of computing the diagram in the way I am here contending for is as simple as the other way, except for the operation of deducting the isolated back pressure area from the main pressure area. The two separate areas may be easily measured by the planimeter, and the substraction of the one from the other is child's play. Nor is it at all necessary to separate the diagrams for the two strokes, as I have here done to make the explanation easy, as each one, if looked at alone, is clearly defined and easily distinguished from the other.

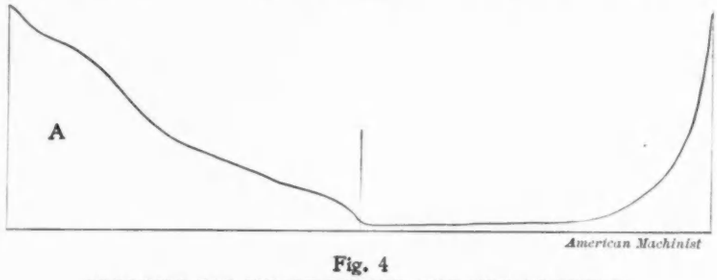


Fig. 4

PRESSURE FOR WHOLE STROKE, ONE SIDE OF PISTON.

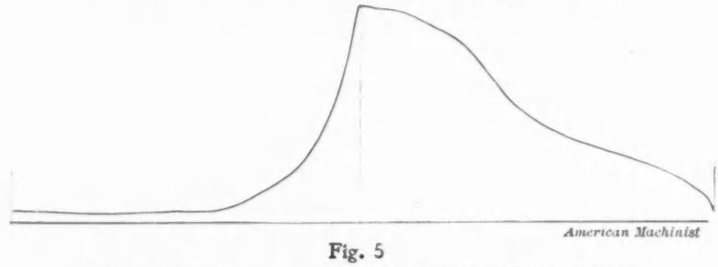


Fig. 5

PRESSURE FOR WHOLE STROKE, OTHER SIDE OF PISTON.

THE CONTINUOUS DIAGRAM.

It is well, I think, to get into the habit of regarding the indicator diagram as a portion of a continuous one, instead of looking at the single diagram as unrelated to anything else. It has helped me, I think, to get a better idea of the actual distribution of the unbalanced pressure. Fig. 4 represents the entire previous diagram *A*, with the second stroke assumed to be made in the same direction as the first. If a copy of this diagram is traced on a slip of tracing paper and the last half of it folded back over the first at the central dotted vertical line, bringing the atmosphere line, of course, to coincide with itself, it will be found that diagram *A* is completely reproduced. Fig. 5 shows diagram *B* treated in the same way. These diagrams, by the way, are on a smaller scale than the first three figures, but they convey the idea just as well. In Fig. 6 we have the two previous diagrams combined, by tracing one over the other, and if this also is folded back to the left upon itself at the central line it will be found to reproduce Fig. 1 completely.

All that these diagrams bring out is of course in plain sight in Fig. 1, but still habit is strong with us, and a new point of view often makes us see particulars not before noticed. The diagram that we

have been considering here represents a locomotive hard at work and developing considerable power, say 250 horsepower. Probably there is not one man in a dozen, although he knows better when he stops to think, or sees it in a minute when it is pointed out to him, who does not think of the steam as actually more or less effective for driving the piston clear to the end of the stroke, or at least until the exhaust lets go, which is very close to the end of the stroke. The driving pressure is really equaled by the back pressure at *x*, or at about four-fifths of the stroke, and for the remainder of the stroke the excess of pressure is of course backward instead of forward. So in diagram *B* the balance of pressures occurs at *t*, or about six-sevenths of the stroke.

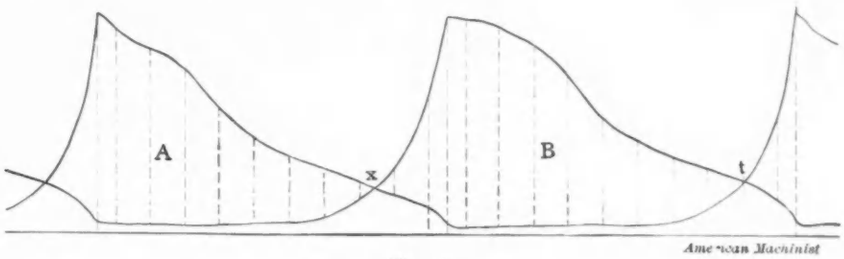


Fig. 6

COMPLETE CONTINUOUS PRESSURE DIAGRAM.

We get a still more complete and effective realization of the actual distribution of the effective pressure if we construct Fig. 7 from the preceding. A sufficient number of vertical ordinates are first drawn on Fig. 6. As a matter of fact I used twenty instead of the ten here shown. Then in Fig. 7, *w v* being the line of no pressure, these ordinates are taken in their regular order and their successive lengths measured off from *w v*. Those preceding the points *x* and *t* are, of course, above *w v*, while those that follow *x* and *t* are below *w v*. The lengths of these successive ordinates locate and enable us to draw the lines *a e x d* and *d o t a*, which represent the unbalanced pressures at the successive points of the stroke. This diagram gives us in a striking way the actual fluctuations of pressure and the suddenness of them. We are very apt to think of the moment when exhaust occurs as an easy time for the piston, and we complacently speak of it as the point of release; but this is really near the most exciting part of the whole stroke, and the so-called release may itself as well be considered an application of pressure (which it is to the other side of the piston) as a withdrawal of pressure. It will be noticed that the vertical lines are designated by the same letter at both the top and the bottom, these points being identical as far as the pressure against the piston is concerned, but reversed in full strength of pressure upon the crank-pin as it passes the center.

There is of course nothing new in any of the preceding. It is, however, the fact, as stated at the beginning, that our practice is almost universally incorrect, and it is strange, and to me unaccountable, that it should so long go entirely unchallenged. It is at least a waste of labor to go too minutely into other matters connected with steam engine testing without at the same time being more correct than we have been in our use of indicator diagrams.

TECUMSEH SWIFT.

▲ ▲ ▲

Details of Deep Well Pumps.

Editor American Machinist:

Referring to W. H. Booth's article in the "American Machinist" of August 25, 1898, about deep well pumps and appliances, I have used the long-grooved buckets, such as he speaks of, with excellent results when the water is clear and free from sand and other foreign substances, but where sand is present in large quantities the bucket soon wears so that it acts more like a churn dasher than a pump bucket. I would much prefer a bucket with four or five good cup leathers and a ball valve, and for extremely deep holes would recommend nothing else, while for medium lifts—50 to 100 feet—cylinders, with rubber disk valves, will give very good results. It is usual with driven wells in this country to have more or less trouble with sand when new, especially if the casing is stopped in sand or gravel, using screen at bottom, but in wells where the drill is stopped in the rock they will often clear up in an hour or so.

The cylinders are usually made of seamless brass tube one-quarter inch or one-half inch less in diameter than the bore of column pipe. The bottom of the bucket is tapped so as to screw onto the top of the check (the check fits in taper), so as to remove both at one haul. The sucker rods are usually of wood, some makers using iron, but my experience is that an ash wood rod with taper box and pin couplings is the very best. The straight box and pin couplings are mostly used, as they are much the cheaper and are very good. The wood rods have a floatage that is very desirable. In a case where I put one down 700 feet it required the weight of two workmen to force the rod down. The rods have no guides or rollers.

The same rods and cylinders are used for pumping oil wells, often going down 2,000 or 3,000 feet. The oil wells usually work with the walking-beam that was used in drilling the hole. My experience has been with steam working heads. These heads have a stroke of 8 to 36 inches, according to size. Always use the longest stroke on the deep holes. Pumps are rated at twenty strokes per minute, but where the well is free this can be doubled.

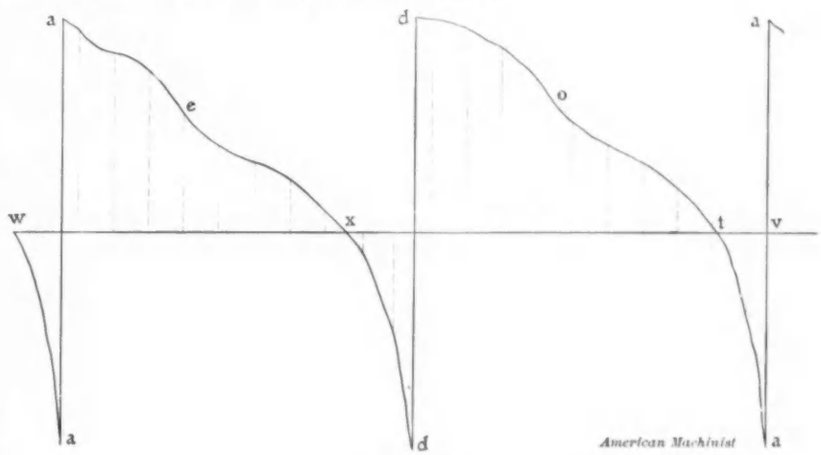


Fig. 7

DISTRIBUTION OF NET EFFECTIVE PRESSURE.

The steam heads have a displacement plunger of approximately half the area of bucket, so that the discharge on the up and down stroke is about even, and if the discharge is above steam head the displacement plunger balances the weight of rods and bucket. I have placed these 200 feet to 500 feet below ground line and discharge 100 feet to 150 feet above ground.

HUGH HILL.

▲ ▲ ▲

A Bending Operation.

Editor American Machinist:

The sketches herewith illustrate a bending die that may interest some of the

readers of the "American Machinist." We had to bend the blank, Fig. 1, of No. 14 sheet brass to the shape of Fig. 2 and preferred, of course, to do it in one operation if possible. The blank we made in the usual way, first perforating, then blanking. The punch for bending is shown in Figs. 3 and 4. The blank is placed on the punch and held by the clips *B B*. The two parts of the die *G G* are pivoted, as shown in Fig. 5, and are held in the elevated position by the spring-actuated rod *I*. As the blank is carried down by the punch the blocks *G G* assume the position indicated by the dotted lines. This allows the stock to take the desired shape with a minimum amount of stretching. There is no appreciable change in the width of the blank, although it was found necessary to make the holes *n n* in the blank oval, as shown, in order to have a round hole in the finished stamping. *F* is a gage pin fitting the center hole in the blank.

The bolt *c*, with a knurled nut *D* and spring *n*, allow the clips *B B* to open enough to clamp the blank securely to the punch. *O O* are pins fitted to drive through the punch and loose in *B B*.

W. A. WARMAN.

Rochester, N. Y.

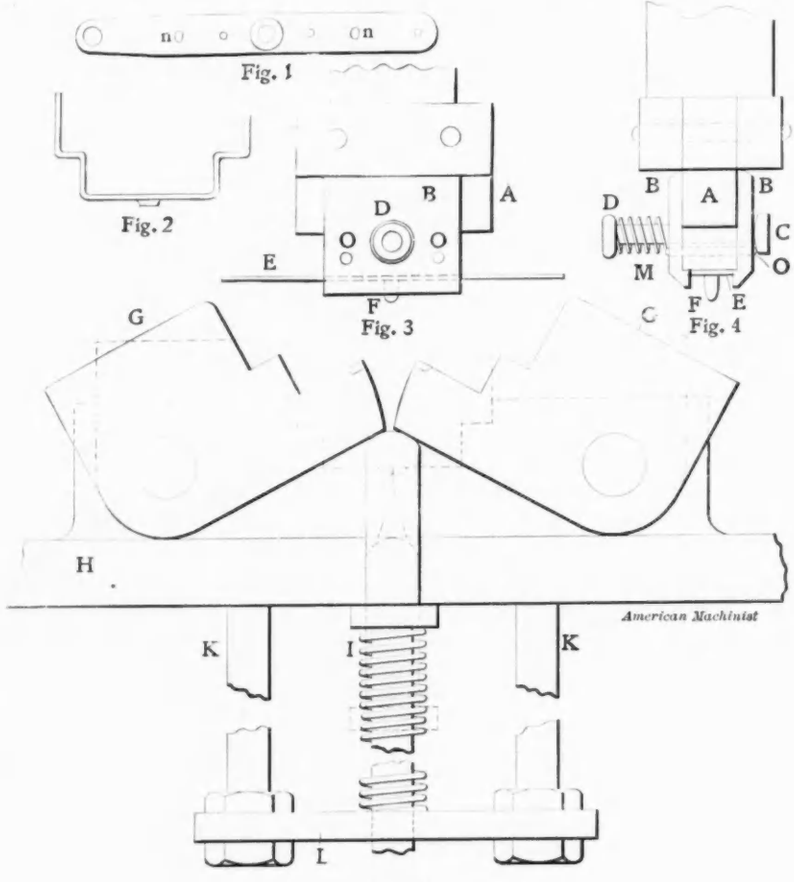


Fig. 5

A BENDING OPERATION.

Flexible Coupling.

Editor American Machinist:

The device illustrated and described by Mr. Morris Fulton in your issue of September 1, for driving one face plate from another, the two rotating in parallel planes, and the motion being transmitted by a plurality of connecting rods, or straps, is, as he supposes, an old one. Among many Kinematic models in the Engineering School (Franklin College), of the University of Georgia, made by James Rigg, of Chester, Pa., not less than fifteen years ago, is one in which rotation is communicated from one disk to another by means of three connecting rods. The crank pins are at 120 degrees to each other, the longitudinal axes of the connecting rods being at an angle of about 8 degrees to the surface of each disk. I have, however, never seen it applied to any commercial machine.

LAMAR LYNDON.

New York.

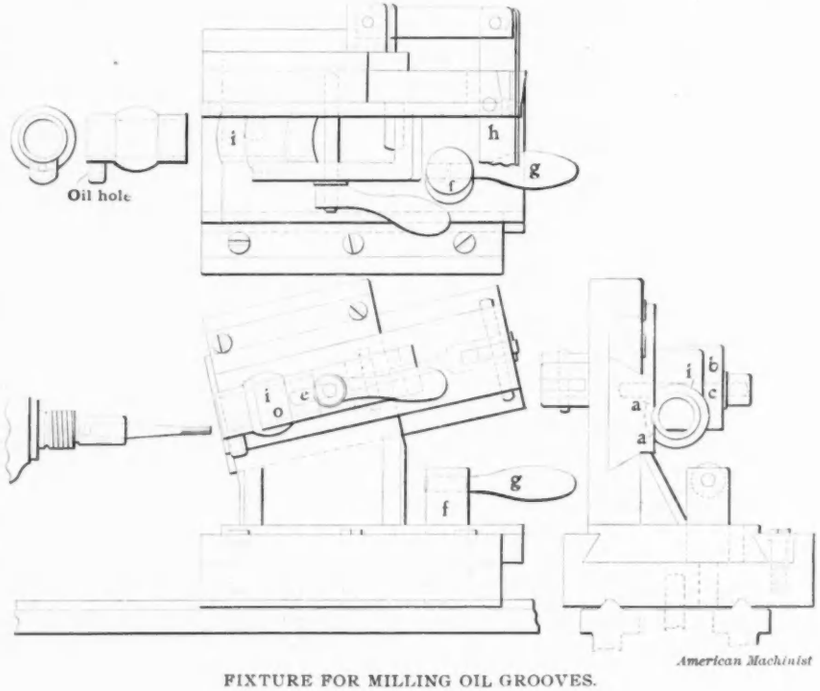
▲ ▲ ▲

For Milling Internal Oil Grooves.

Editor American Machinist:

With the aid of the accompanying sketch I will tell you how we cut the oil grooves in mower pitman boxes. Having several thousand of them to cut it was necessary to fix up some kind of tools to cut them with. As will be seen by reference to the sketch, the rig provided is an attachment for the hand lathe. The cutter is a small end-mill, about 13-64 inch in diameter, and not a small half round cold chisel that is generally used for such jobs, and which it was expected would be used in this case. The boxes to be milled are brass or phosphor bronze. The hole is reamed to 15-16 inch and the ball is turned to 1 11-16 inch diameter.

The box is placed on the Vs *a* and clasped by the strap *b* and the screw *c*, which has the handle *d*. The strap is



FIXTURE FOR MILLING OIL GROOVES.

slotted at *e* to allow it to slip back out of the way when changing the boxes. The fixture has two slides—a horizontal slide, operated by the eccentric *f* and handle *g*, and an inclined slide above it operated by the broken off bar *h*. As shown in the sketch a new box *i* has just been clamped in position. Upon turning the eccentric *f* half way around, so that *g* points toward the headstock, the box is carried along so that the mill is just ready to begin cutting at *o*, the corner of the channel which leads up from the oil chamber below. The box is then fed along by the bar *h* in a direction parallel to its base, until the groove is cut to the required length, a stop pin being provided on the slide to determine the travel. The fixture must be so placed on the lathe bed that the mill will come to the right position for cutting when the eccentric is turned forward. In fact the depth of the cut is regulated in this way.

This does a very neat job, especially as it was thought best not to have the groove cut clear to the end of the box, and it would have been a difficult job to chip them without jamming.

GEO. H. FRIZZELL.

Chicago, Ill.

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Bicycle Nipple Washer Press.

The accompanying illustration shows a new machine which has just been brought out by the Fox Machine Company, of Grand Rapids, Mich., for inserting nipple washers in bicycle wheel rims.

The washers are supplied strung on wires, from which they are readily transferred to the feeding wire of the machine, as shown in the illustration. In use the shuttle at the front of the machine drops the washers one at a time on one of the pilot pins of the turret, which is plainly shown. The turret revolves one step at each revolution of the press, the washers being retained on the pins by suitable fingers until the pin enters the hole in the wheel rim, when the finger withdraws, the turret plunger descends, and settles the washer firmly in place. The saddle or support for the wheel rim is adjustable and is held up by a spring having the proper tension. This not only compensates for variation in the thickness of the rim, but sets every washer with practically the same pressure. The friction drive is controlled by a toggle joint, and by means of a foot lever is under the control of the operator.

The capacity of the press in ordinary work is stated to be 50,000 washers per day.

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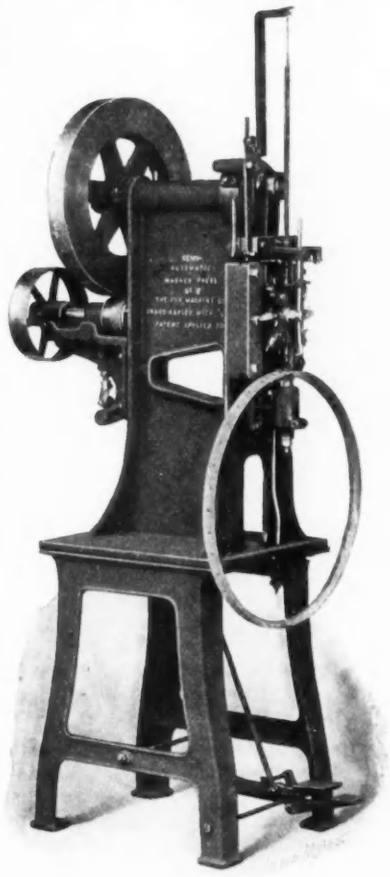
Standard Slots for Fillister Head Screws.

The cylindrical headed screw, with either flat or spherical top, and a cross-slot for a screwdriver, is quite an important element in the construction of many machines, especially the machines of the machine shop. The shells of chucks are held together by them, aprons are fastened to lathe carriages, and brackets of various kinds are attached by these screws. They are very neat and satisfactory in many places when new, but are quite liable to abuse and to soon become demoralized if frequently unscrewed and screwed up again. The necessity of having the screwdriver fit the slot is not generally recognized and insisted on. There is a general readiness to try to turn the screw with anything that will go into the slot, whether it is both wide enough and thick enough to fill the slot or whether



BICYCLE WHEEL RIM WASHER PRESS.

it is neither. These screws are usually intended to be, and should be capable of being, screwed up to a tension somewhat commensurate with the strength of the thread, and to do this, and especially to do it more than once or twice, it is very necessary to have the screwdriver both fill and fit the slot. It is more necessary to have a screwdriver fit the screw slot correctly than it is to have a wrench fit a hexagon head or nut properly, for the simple reason that the driving edges of the screwdriver usually press the sides of the slot with considerably more pressure in proportion to surface than the jaws of a wrench apply. If anyone with an average supply of modern machine tools will undertake to see to it that there shall be a perfectly fitting screwdriver for every screw he will find that it will require a great many screwdrivers. There seems to be no standard, or, what is worse, no insistence in practice upon any standard for the size of the slots. Mr. T. R. Almond calls our attention to this matter, as it has caused him considerable trouble, and it would seem to be very desirable to adopt a better practice.

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The Patent Law Revision Committee.

An act of Congress approved June 4, 1898, provided for the appointment of three commissioners to revise and amend the laws of the United States concerning patents, trade and other marks, and trade and commercial names, which shall be in force at the time such commission shall make its final report, so far as the same relates to matters contained in or affected by the convention for the protection of industrial property concluded at Paris March 20, 1883, the agreements under said convention concluded at Madrid April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels in December of last year, and the laws of other nations relating to patents, trade and other marks and trade or commercial names.

The President has named as commissioners Judge Peter Grosscup, of Chicago; Francis Forbes, secretary of the United States Trade Mark Association, and Assistant Commissioner of Patents Greely. The commission will hold its meetings in Chicago, and it is expected that it will convene some time during October. The law provides that the report of the commission, which will be laid before Congress during the next session, shall be so made as to indicate any proposed change in the substance of existing law, and shall be accompanied by notes which shall briefly and clearly state the reasons for any proposed change. It must also be accompanied by references to such treaties and foreign laws relating to patents and trade marks as, in the opinion of the commissioners, may affect citizens of the United States.

The report of the commission will be awaited with interest by the manufacturing interests of the country, as it will have an important bearing on proposed patent legislation.

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Pull the String.

What seems like an unnecessarily strict interpretation of the postal laws prevents us from printing on the outside of the wrapper anything to indicate that there is in it a string, which, if pulled, cuts the wrapper open. The string is there, however, and no knife or other implement is required to open the wrapper and get at your copy of the "American Machinist."

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For Modern Navy Yard Equipment.

We as a nation have not the slightest occasion to feel ashamed of our sea-going fighting machines, in either their design, construction, maintenance or manipulation. We have in our recent trial of them surprised all the world, and ourselves perhaps as much as any, with their condition of ready and complete efficiency. It seems apparently to be conceded all around that our navy in the future is to be of still more importance and magnitude than in the past or the present. We are to have in still larger numbers as good fighting ships as man can devise.

It is necessary and proper that everything connected with our navy shall be of a piece with the rest. Of especial importance are the means and facilities for repairing our machines, for general overhaulings and refittings, for replacing broken and worn parts, for the making of alterations and improvements and for the conducting of the numerous experiments which experience may suggest. A railroad without efficient and up-to-date repair shops is in a bad way. The modern ship of war is as completely and exclusively mechanical as is any railroad, and its repair shops are of still more importance to it than to the railroad, as the opportunities of repair to the individual machine are less frequent.

One might easily think, from the generally effective condition in which our ships were found when the emergency arose, that their condition was the natural result of the maintenance of finely equipped repair shops or navy yards. One has to go no farther than across the river from where we write to see one of these repair shops. If anyone familiar with modern machine shop practice and equipment will look over the shops of the New York Navy Yard he may find it difficult to avoid the impression that this is the shop which was largely responsible for the condition of the fleet of Cervera or of Camara, rather than for that of Dewey or of Sampson. It might be a passable Spanish navy yard, but it is an utterly discreditable equipment for a great and proud modern nation of the first class.

We are not in this going in the least outside of our perfectly legitimate field of remark, nor speaking of anything of which it is not our business to know something. We are familiar with the insides of shops, and yet would find it difficult to point to one private establishment in all the land so poorly fitted for profitable business as are the shops of the United States here referred to. The mechanical equipments of machine shop, blacksmith shop, iron and brass foundry, boiler shop, coppersmith shop and the rest are hopelessly antiquated and utterly inadequate. The few modern tools that have strayed into the shop seem absurdly out of place. A Sellers tool grinder is close beside an ancient drill with the worst cut up table we ever saw. A Jones & Lamson flat turret lathe suggests an inquiry as to what it can possibly be doing in such company. Most of the tools date back thirty years or more. It is certainly time that the shops were reconstructed and freshly equipped. A good beginning would be made if someone could have authority and nerve enough to destroy all the old and worthless material—the actual junk—scattered around. A sweeping fire that would wipe out every trace of the shops above referred to would be one of the greatest of blessings to the Navy Yard.

We lately spoke with pleasure of the fine equipment of the repair ship Vulcan. That was the very satisfactory embodiment of an admirable idea. The ship, we understand, is doing excellent work, and demonstrates daily her value. Similarly equipped shops ashore are of course still more necessary, and it should not be difficult to get them if those in high authority can be made to appreciate their importance and the absurdity of our present worthless relics.

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Inward and Outward Turning Screw Propellers.

We notice in the daily press an account of a trial on Mr. Howard Gould's new twin screw yacht of inward and outward turning screws. The outward turning arrangement is the usual one, but there has been much discussion on the subject, some naval authorities having held that the inward turning plan is superior, and, accordingly, Mr. Gould's yacht was fitted with inward turning screws, under which arrangement at 128 revolutions per minute it developed a speed of only 12.58 knots per hour. This was not satisfactory and outward turning screws were substituted, when the boat made 14 1-5 knots at 120 revolutions per minute.

The circumstance is taken as proving the superiority of the outward turning screws, but to form a final judgment on a single experiment would doubtless be premature. There are few mechanical details which are surrounded by so many conditions which react on each other as the screw propeller. Of two screws tested in comparison one may show itself superior in one case and the other in another, and, in fact, there is probably no mechanical detail regarding which it is so difficult to make generalizations as the propeller. While therefore the experiment with Mr. Gould's yacht is highly interesting and significant, it can hardly be taken as proving the case.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(87) G. H., Detroit, Mich., says: "We have a gas engine and have lots of trouble with the igniter. I have to file the points twice a day; they are common steel points. Please inform me what is the best metal to use for points to get the most effective spark?" A.—Platinum.

(88) S. W., Pocatello, Idaho, wishes to know how the pitch diameters of bevel gears are measured. A.—The pitch circle of a bevel gear is understood to be the pitch circle of the outer end of the teeth. The diameter is obviously the same as that of a spur gear whose pitch diameter is equal to that of the outer end of the bevel teeth.

Inquiries for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

63. From Australia, for machines for manufacturing pricked gratings for quartz batteries.

64. From Germany, for machines for coating typewriter ribbons.

65. For makers of the "Agitator" and "Aggravator" emery wheel dressers.

66. For makers of what is known as "Ajax" soldering flux.

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Personal.

W. Cairns has resigned the position of superintendent with the Spaulding Machine Screw Company, of Buffalo, N. Y., and accepted a similar position with the Monarch Cycle Manufacturing Company, Chicago, Ill.

S. S. Drabble, late of the Sandy Hill Iron & Brass Works, Sandy Hill, N. Y., has bought one-half interest in the Granby Iron Works, Granby, Que., Canada, and is now occupying the position of superintendent.

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Few would have believed in 1893, when Broadway was torn up to put in cables for the Broadway cars, that in five years it would be torn up again to substitute electricity for the cable. The cable has served its purpose—has been far better than the horses it supplanted, but the underground trolley lines installed in other streets of the city have been so successful and satisfactory in every way and have shown themselves so much superior to the cable that it has been decided to make the change on Broadway at once.

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Commercial Review.

NEW YORK, Saturday Evening, September 10.

GENERAL REMARKS.

The "Federal Steel Company," the new trust, embracing the Illinois Steel, Minnesota Iron and other interests, has just been incorporated in New Jersey with a paid in capital of $200,000,000. A rapprochement among the tin plate manufacturers for a similar purpose has for quite a while been in progress, 75 per cent. of the mills having, it is said, given options. The present conditions of general business are almost unprecedentedly favorable for a revival. The paralyzing influence of hot weather has been withdrawn and the present stringency of the money market is not expected to be serious.

IMPORTANT ELECTRICAL CONTRACTS.

We have already mentioned that the Snoqualmie Falls Electric Power Company, Washington State, is about to install a large electric plant to generate current for transmission to the cities of Tacoma and Seattle. It transpires that a contract for the electric machinery, to the amount of 10,000 horse-power, has been let to the Westinghouse Electric & Manufacturing Company, from whom we have received particulars in regard to it. The power station is located forty-five miles from Tacoma and thirty-one miles from Seattle, and, in spite of this great distance of transmission, it is agreed that the losses in generators, transformers and line shall remain normal.

"The contract involves the building and delivery at above points of four three-phase, rotary armature, generators, having a normal aggregate capacity of 6,000 kilowatts, and which are to be direct connected to water wheels; two 75 kilowatt kodak exciter dynamos, also to be direct connected to water wheels; high and low potential switchboards, for main power station and sub-stations at Seattle and Tacoma, involving seventy-six marble panels with all necessary instruments, switches, etc.; high tension oil insulated static transformers having an aggregate capacity of 10,875 kilowatts; rotary transformers with a total output of 2,700 kilowatts, and six type 'C' motors developing 1,600 horse-power, with adequate lightning protection at both ends of the line. These machines when installed will make available for industrial, railway and lighting purposes the power of Snoqualmie Falls. The line potential will be 25,000 volts, and its current will be carried over bare aluminum wires to sub-stations, where lowering transformers will sufficiently reduce the voltage for safe transmission within the corporate limits of the two cities."

The Walker Company has closed a contract to furnish the Brooklyn Heights Railway Company with 600 motors, amounting in value to about $300,000, for addition to its equipment.

MACHINISTS' SUPPLIES, ETC.

The average tone among supply dealers in this city is hardly as strong as might be expected in view of the favorable circumstances existing. Yet the fall increase of trade appears to be coming in to some extent. The hot weather which has continued almost up to date has necessarily had a most energizing effect upon trade, but that, happily, is over, and after a week or two of fall breezes an improvement will no doubt be felt by those houses which hitherto have failed to experience it.

The market for power transmitting machinery is active, there being a good number of small orders. This was the case with those which came from Europe during the last fortnight to one wood-pulley company. They were from ten different points, yet amounted altogether to but two or three carloads of pulleys.

The concern alluded to mentions, obiter, that it has received a request from a party in the north of Europe for advice as to the equipment of a factory for making split wood pulleys over there. Our informants did not counsel him to proceed. Aside from the undesirability of the thing, on the ground of competition, they say that the enterprise would not pay the projector. He would be able to sell but five pulleys of a size, where the American sells a hundred, for he would have little but the European market to

(Continued on page 34.)

▲ ▲ ▲

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Cutters, reamers and small tools, regular and special; vertical millers, cutter and surface grinders, shears and punches. R. M. Clough, Tolland, Conn.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced mechanical draftsman, now employed, wishes to change. Address Box 229, AM. MACHINIST.

Die maker, drawing, combination, cutting, large experience, wants situation. Box 224, AM. MACHINIST.

First-class mechanical draftsman desires permanent pos.; 14 years' shop and office ex. Box 223, AM. MACH.

Foreman, pattern and draftsman; a good, steady, reliable man; good ref. Box 202, AMERICAN MACHINIST.

An experienced steam and gas engine designer wants position as superintendent. Box 216, AM. MACHINIST.

Detail draftsman; experienced graduate of technical school; good reference from late position. Box 226, AMERICAN MACHINIST.

Experienced draftsman, technical graduate, with leading manufacturers of air and gas compressors, wishes to change. Box 230, AMERICAN MACHINIST.

Wanted—Position as general foreman or superintendent; large exp. on fine machinery and tools; can handle help to best advantage. Ad. Box 231. AM. MACH.

Wanted—Position as foreman by a man at present in charge of machine shop employing seventy-five men; best of reference. Address Box 228, AM. MACH.

A first-class mach. and draftsman wants position as foreman or assist. supt of machine shop; has held positions as general foreman; best of references furnished. Box 208, AMERICAN MACHINIST.

Wanted—Position by foreman of extensive experience and a hustler on tool building, special machinery, gas and steam engines and general repairing; best of references. Address Box 222, AMERICAN MACHINIST.

A manager who has had long experience in general manufacturing and construction desires a position of responsibility; competent to direct, but will fill any position in works or office. Ad. Box 225, AM. MACH.

Wanted—Position as general manager or super. of engine and general engineering works; accustomed to handling all depts.; thoroughly ex. in the produc. of work and the handling of men. Box 227, AM. MACH.

Wanted—By an experienced mach. and draftsman, a position of responsibility, either in the shop or on the road setting up machinery; has served as general foreman; can furnish first-class references. Box 209, AMERICAN MACHINIST.

A mechanical engineer desires to make a change after October 1; is well up in modern shop practice and has commercial as well as mechanical ability; engines, boilers and appliances a specialty. Address Box 217, AMERICAN MACHINIST.

(*Continued from page 33.*)

depend upon, while American companies have the American as steady diet with the European as an entrée.

The Webster Manufacturing Company has within two weeks past sold in the East about twenty gas engines of from 2½ to 20 horse-power. A contract has been taken to furnish an equipment of shafting, clutches, quill work, etc., for one of the Standard Oil Company's Bayonne (N. J.) plants. The hight of the season for grain handling machinery is said to be past, but its place is well filled by other lines.

The August business of one of the largest New York supply, hardware and machinery houses, Patterson, Gottfried & Hunter, Limited, was 28 per cent. ahead of August last year and more than 20 per cent. ahead of July this year. The former difference was p.rtly due to the addition of various new lines. The firm has just taken the sole agency in this part of the country for the Hugh Hill tool holders.

THE CUBAN TRADE.

We were talking with a gentleman who before the Cuban war carried on a large business with that country in machinery and supplies. He is already noticing symptoms of its revival, for he has shipped to the island two consignments of goods, including wrenches, files, emery cloth, grease, oils, etc. He is rather pessimistic, however, regarding the future of the Cuban trade owing to the antipathies of the native Cubans and the resident Spaniards. It is feared that if the former obtain control of the Government they will revenge themselves upon the formerly dominant race by oppressive measures and that the mutual bickerings will be fatal to industrial prosperity. This view is founded in part upon a letter lately received by our informant from a man on the Spanish side, the owner of what is said to be the largest mill on the island. It is a saw mill employed in the manufacture of cigar boxes and run by two Corliss engines. He is now trying to dispose of this property, which fact shows that his fears are honest. We presume, however, that our Government before abandoning Cuba to its own devices will ascertain that it is in a fair way to behave itself.

The agent for an Eastern small tool manufacturer tells us that he has furnished circulars to a man who has gone to Cuba to open up offices for the sale of such lines of goods in Havana and elsewhere.

Nearly $8,000 worth of sugar machinery started for Havana to-day on a Ward Line steamer.

MISCELLANEOUS.

We learn that the Turner, Vaughn & Taylor Company, Cuyahoga Falls, Ohio, is selling an increased amount of its machinery, including considerable for for-

Help Wanted.

Wanted—A competent mechanical draftsman on light machinery; should have a good technical education and some experience in shop practice; state salary expected. Address Baltimore, care AM. MACH.

Wanted immediately an up to date, exp. foreman of machine shop; one accustomed to heavy marine engine work; will consider only first-class man, with satisfactory references. Apply by letter to the Harlan & Hollingsworth Company, Wilmington, Del.

Wanted for England, a first-class machine tool draftsman as designer; accustomed to high-class milling machines, hand and automatic screw machines, &c.; good berth for a capable man. Reply, giving full particulars of age, experience and salary required, in confidence, to Box 221, AM. MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Philadelphia Book Co., Phila., Pa., catalog free.

Caliper catalog free. E. G. Smith, Columbia, Pa.

Dies and press tools. J. L. Lucas, Providence, R. I.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale Cheap—One large 11 ft. planer; Edwin Harington & Son, Phila., Pa. Martin Hamm, Strasburg, Ill.

Wanted—A good second-hand universal milling machine, back geared; give condition, make, price, description. Address Box 232, AMERICAN MACHINIST.

Gasoline Engines, all sizes, 1 to 60 H. P.; send for circulars, terms and prices; castings fur. to build your own engs. Dirigo Eng. & Mach. Works, Portland, Me.

The advertising department of the American Machinist has on hand 20,000 draftsm'n's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

LOOK HERE!—Buy yourself a Machine Shop all fitted up with first-class tools and machinery, on easy terms. If you have a friend with some money who is a machinist, call his attention to this. Address MARTIN HAMM, Strasburg, Shelby County, Ill.

OIL FILTERS

THE BURT MFG. CO., Akron, O., U. S. A.

14 IN. x 5 FT. Bradford Muller Lathes.

25 of them. Almost New. Low Price.

The Lodge & Shipley M.T. Co. Cincinnati, O.

BARGAINS IN

NEW AND SECOND-HAND MACHINERY.

Lathes, from 12" to 48"; Planers, from 20" up to 60. 48", 54" and 60" Radial Drills; No. 2 Newton Milling Machine; No. 2 Screw Machine; Shapers, from 6" to 30", Boilermakers' Punches, Shears, Edge Planers, Rolls, Drills, Engines, Boilers, Pumps, and Dynamos.

FRANK TOOMEY, 131 N. THIRD ST., PHILA.

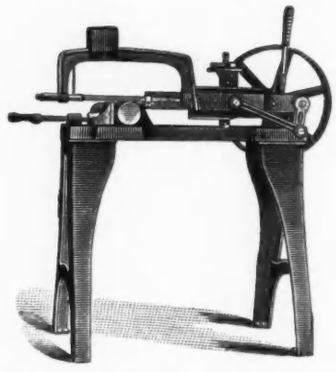
IMPROVED 16' & 18' ENGINE LATHES

RAHN & MAYER

216 W. Pearl St., CINCINNATI, OHIO, U. S. A.

"The best is as good as any."

The New Automatic and Gravity Feed Q & C Shop Saw



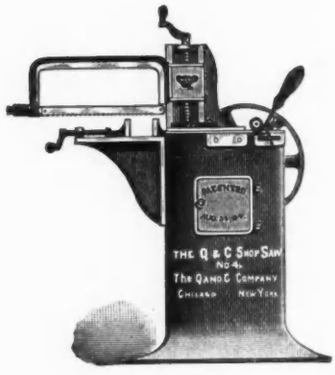
Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.

Quality—'Way up.

Shop Saws, Portable Rail Saws, Cold Power Saws,

For All Purposes.

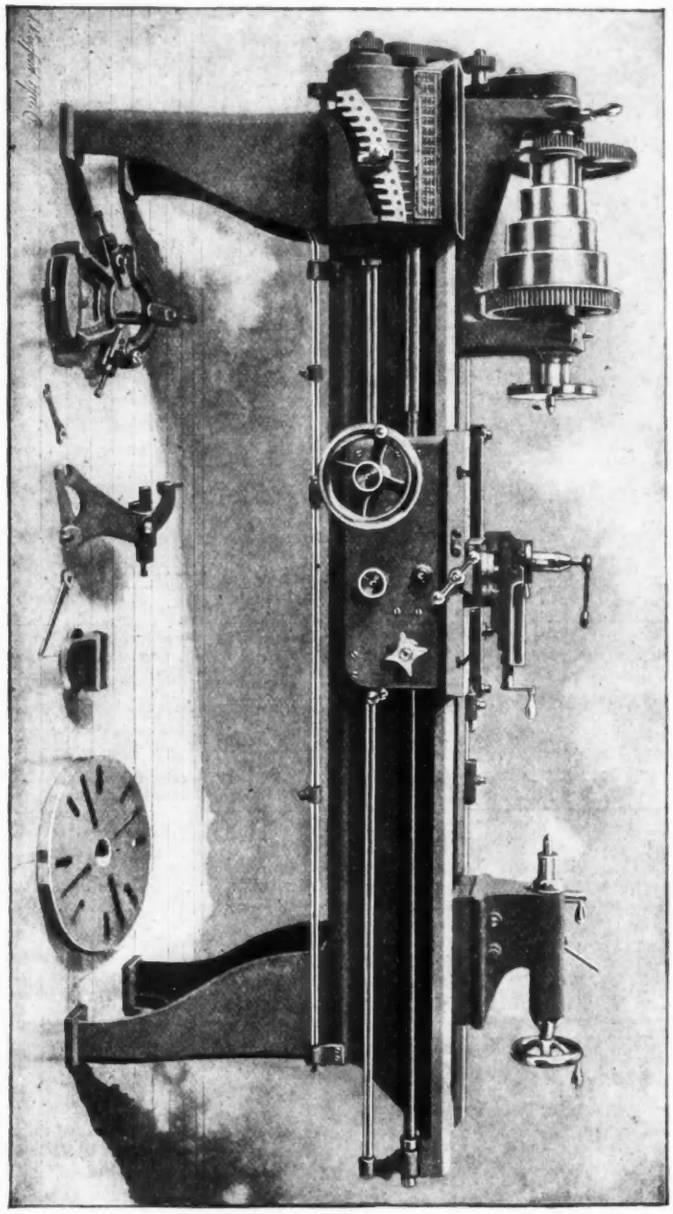


Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.



18-INCH HENDEY-NORTON LATHE.

ALL these Lathes have the Norton Screw Cutting feature. All the different threads and feeds in daily use obtained by moving the handle in gear box from one notch to the other. All sizes but the 32 in. fitted with our Automatic Stop Rod for carriage. By its use you can cut threads to and from shoulders and always have the carriage stop in the same place. All lathes have the reverse motion in head, operated by lever at side of apron. By this you reverse the carriage only, which is all that is necessary in cutting threads.

These attachments mean a great saving of time and labor.

THE HENDEY MACHINE CO.,

Torrington, Conn.

AGENTS FOR THE PACIFIC COAST:

PACIFIC TOOL & SUPPLY CO., . . San Francisco, Cal.
J. W. CREGAR, . . Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:

SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

eign account. A plant of improved chain making machinery was shipped to the H. Schlieper Company, Iserlohn, Germany, during the past summer, and another is now being sent to Liverpool. Further business of the same nature is expected from Germany. The Kelly Nail & Iron Company, Ironton, Ohio, is to equip its new wire nail mill with a complete plant of wire drawing machinery of this make.

CHICAGO MACHINERY MARKET.

The consensus of opinion in the machinery trade is that business is brighter and that it is steadily brightening. There are a few sellers of machinists' supplies who are disappointed. They anticipated one of the old-time markets, when the fall trade set in, one with an irresistible impulse and with a boom trailing in its wake. Conditions like those have not been attained by the rank and file of traders in iron machinery. The generality of reports are to the effect that business has improved quite perceptibly. Gains are the rule in footings, whether the comparison be made with the previous two or three months or with the corresponding period last year, and when the comparison is with the more recent period the percentage of increase is quite satisfactory. Both East and West railway equipment has become scarce within the past week or two, and that fact registers the general improvement in business, which is reflected among the machine shops throughout the West. But the activity is not preternatural. It is a wholesome growth and one that bids fair to remain.

In the crude steel markets the same tendencies are noticed, a steadily widening of the "sphere of influence" of the product without violence to previous conditions, an absorption of material by the country to a degree that is unprecedented, but at the same time less noticeable than it would formerly have appeared. Prices for the crude material are steadily advancing. For steel bars there have been within several weeks three advances of $1 per ton each. Merchant steel is higher and mills are slow, both in taking new orders and in making deliveries on old contracts. The strength of the market is the effect of the scant supply. Agricultural and vehicle manufactories are contracting actively for their next year's needs of material and are doing so on a liberal scale. They are buying machinery with equal freedom. The bicycle works have not yet started up for the new year, but are expected to be in full operation next month.

Foreign trade is sought by machinery builders with no less energy than when it was more a matter of necessity, and fresh inroads are being reported upon the world's markets. During the past week

(*Continued on page 36.*)

(*Continued from page 35.*)

several large evaporating plants were sold by a Chicago maker to packers in Australia in competition with producers from Europe.

The Niles Tool Works Company has just fitted out with machinery the new shops of the Chicago Great Western Railroad Company at Oelwein, Ia. The company removed from the old shops at St. Paul a number of tools, but the requirements of the new shop called for a large amount of new machinery equipment.

The sales of the Chicago office of the Pratt & Whitney Company during the months of June, July and August, this year, were over 20 per cent. larger than for the corresponding period last year. The business for the year to date also shows a marked increase.

▲ ▲ ▲

Quotations.

NEW YORK, Monday, September 12.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 25 @ 11 50
No. 2 foundry, Northern	10 75 @ 11 00
No. 2 plain, Northern	10 25 @ 10 50
Gray forge, Northern	9 75 @ 10 00
No. 1 foundry, Southern	10 75 @ 11 25
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 25 @ 10 50
No. 1 soft, Southern	10 75 @ 11 25
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, Southern	9 50 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.20 @ 2.25c., according to quantity.

Copper—Carload lots, Lake Superior ingot, 12½c.; electrolytic, 12⅛ @ 12¼c.; casting copper, 11⅞ @ 12c. for ordinary brands.

Pig Lead—Carload lots, 4c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 16.20 @16.25c., f. o. b.

Spelter—Carload lots, 4.75c., New York delivery, for ordinary brands.

Antimony—In cask lots: Cookson's, 9⅝ @ 9¾c.; Hallett's, Japanese and French E. B., 9c.; United States, 8¾c.

Lard Oil—Prime city, ice pressed, 45c. in wholesale lots.

▲ ▲ ▲

Manufacturers.

The Talladega cotton factory, Talladega, Ala., is building a cotton factory.

F. B. Walker, Park Rapids, Minn., has decided to build a double band saw mill at Akerly, Minn.

The Inland Steel Company, Chicago Heights, Ill., is preparing for an extensive addition to its plant.

William P. Hartman, of Hudson Hill, N. Y., whose steam mill was recently destroyed by fire, will rebuild on the same site.

Wm. E. Gang & Co., Cincinnati, Ohio, have recently removed into their new shops at 1543 Queen City avenue, Cincinnati, Ohio.

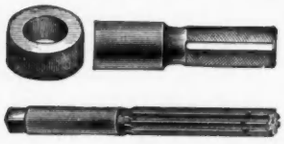
The Oesterlein Machine Company, of Cincinnati, with a capital stock of $30,000, has been organized by Wm. Oesterlein, and others.

The Jenkins & Bogart Manufacturing Company, Kingfield, Me., are making repairs and additions to their mill since the recent fire.

The Palen Company, of Kingston, has been incorporated to manufacture tin foil. Capital, $50,000, and directors: J. S. Drake, of Kingston, and two others.

The Granby (Que.) Iron Works contemplate adding new tools, especially wood working tools,

STANDARD MEASURING MACHINES 12 to 48 in. capacity.



Including Microscope and Graduated Bar for insuring absolute standard uniformity. The new Decimal Gauge.

CYLINDRICAL AND CALIPER GAUGES,

Straight and Taper Solid Hand Reamers, Chucking and Shell Reamers, Arbors and Steel Mandrels, Locomotive Taper and Taper Pin Reamers, Combination Lathe Chucks, Milling Cutters. *Ask for the Machinists' Catalogue.*

THE PRATT & WHITNEY COMPANY,
HARTFORD, CONN., U. S. A.

NEW YORK, 123 Liberty Street. BOSTON, 144 Pearl Street. CHICAGO, 42 South Clinton Street. LONDON, ENG., Buck & Hickman, 280 Whitechapel Road. PARIS, FRANCE, Fenwick Freres & Co., 21 Rue Martel.

Hoppes.

LIVE STEAM FEED-WATER **Purifiers**

Keep boilers clean and free from scale. *GUARANTEED.*

The Hoppes Mfg. Co.,

NEW CATALOG FREE. 17 Belmont Ave., SPRINGFIELD, OHIO.

Foreign Offices, 39 Victoria St., Westminster, London, S. W., Eng. 50 Bd. Haussmann, Paris, France.

Thermo-Dynamics of the Steam Engine and other Heat Engines.

By C. H. PEABODY,

Professor of Marine Engineering and Naval Architecture, Massachusetts Institute of Technology. Fourth Edition. Rewritten and Reset.

8 vo, CLOTH, $5.00.

JOHN WILEY & SONS, 53 East 10th Street, New York City.

FINE MACHINE RELIEVED TAPS.

Lightning" and "Green River" Screw Plates, Dies, Tap Wrenches, Bolt Cutters and Drilling Machines for Hand and Power, Punching Presses, etc. SEND FOR CATALOGUE.

WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A.

Agents in London: SELIG, SONNENTHAL & CO., 85 Queen Victoria Street.

WE CLAIM THE FOLLOWING MERITS FOR **JENKINS BROS.' VALVES.**

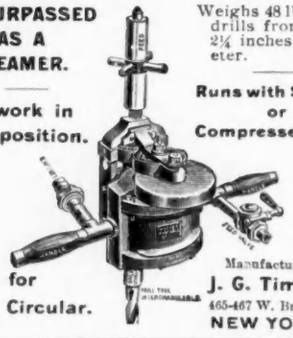
1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.

MOFFET PORTABLE DRILL.

UNSURPASSED AS A REAMER.

Will work in any position.



Weighs 48 lbs. and drills from ½ to 2¼ inches diameter.

Runs with Steam or Compressed Air.

Send for Circular.

Manufactured by **J. G. Timolat,** 465-467 W. Broadway, NEW YORK.

Feed Water Purifier,

combined with heater and mud separator. Constructed on scientific principles. Catalogue sent free.

Maschinenfabrik Grevenbroich,

New York Office: 11 Broadway, Rooms 866 and 867.

"The Reeves" Wood Split Pulley,

with interchangeable bushing system for belt power transmission.

Lighter than an iron pulley. Stronger than a steel pulley. Each pulley will fit thirty-five sizes of shaft. No set screws. No keyway. Complete stocks carried in every jobbing center in the United States. Also:

CHAS. CHURCHILL & CO., 9 to 15 Leonard St., London, Eng.
SCHUCHARDT & SCHUTTE, Berlin, Brussels, Milan.
FENWICK FRERES & CO., 21 Rue Martel, Paris, France.
WHITE, CHILD & BENEY, Vienna, Austria.

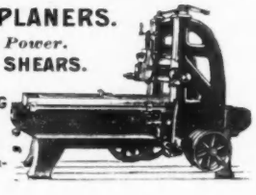
Reeves Pulley Co., Columbus, Ind., U. S. A., Send for Catalogue Manufacturers.

GRINDSTONES

for finishing castings, tool sharpening, etc. Let us select a grit exactly suited to your work.

The Cleveland Stone Co.,
Euclid Avenue, Cleveland, Ohio.

WHITCOMB PLANERS.
Hand and Power.
PUNCHES AND SHEARS.
WHITCOMB MANUFACTURING COMPANY,
Worcester, Mass.
English Agts., Selig, Sonnenthal & Co., London.



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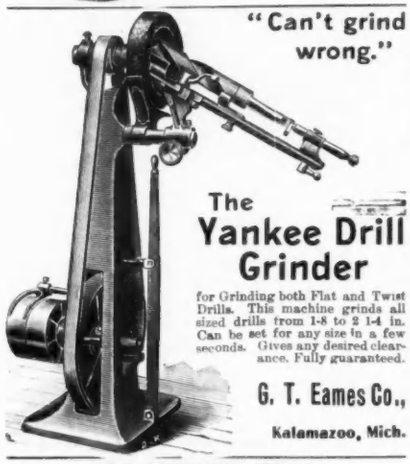
Coal Handling Machinery,

HOISTING ENGINES, "INDUSTRIAL" RAILWAYS, "STEVEDORE" ROPE, &c.

Address the Works:

C. W. HUNT CO.,

Livingston Place, STATEN ISLAND, N. Y.



"Can't grind wrong."

The **Yankee Drill Grinder**

for Grinding both Flat and Twist Drills. This machine grinds all sized drills from 1-8 to 2 1-4 in. Can be set for any size in a few seconds. Gives any desired clearance. Fully guaranteed.

G. T. Eames Co.,

Kalamazoo, Mich.

NOTICE!

We have for sale the entire plant

— OF THE —

AMES MANUFACTURING CO.,

CHICOPEE, MASS.

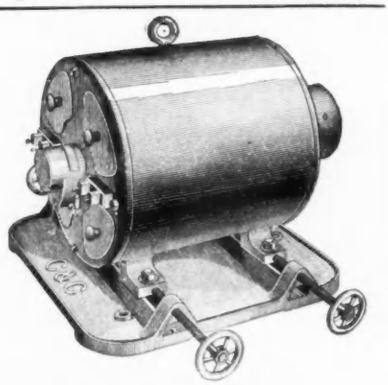
The following are a few of the tools that may be seen at above place:

Wilmarth Pit Lathe.
Turning Lathe, 90 in. x 20 ft.
Pond Planer, 60 in. x 60 in. x 11 ft.
Sellers Planer, 48 in. x 48 in. x 16 ft.
Nos. 1, 2 and 2½ P. & W. Screw Machines.
22 in. x 8 ft. Heavy Screw Machine, friction head.
3 in. Hurlbut-Rogers Cutting-off Machine.
Cold Saw Cutting-off Machine.
Stiles & Parker Punching Press, No. 4.
Stiles & Parker Punching Press, No. 3.
500 pound Drop Hammer.
850 pound Drop Hammer.

SEND FOR COMPLETE LIST.

HILL, CLARKE & Co.,

156 Oliver Street, BOSTON, MASS.



The C & C Slow Speed Closed Ironclad Motor

is especially designed for hard service in mills and factories. Can be placed in any position and belted, direct connected or back geared to its work.

Highly Efficient and Non-Sparking.

Complete Electric Power Transmission Systems.

The C & C Electric Co.,

143 Liberty, Street, NEW YORK.

SAY! Have you struck a snag? I can show a fine record as a designer and inventor. Will take charge while building. Address

A. L. SWEET, Norwich, Conn., or Box 560, Bellows Falls, Vt.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

Auction Sale of factory property at Guilford, Conn. (near New Haven), on Tuesday, Sept. 27, 1898, at 12 o'clock, on premises. Desirable factory; modern construction; railroad siding and easy water communication; main building 3½ stories, 109 x 45 ft; adjacent building, 66 x 45, containing 100 H. P. tubular boiler, 85 H. P. Harris-Corliss engine, pumps, &c.; complete shafting; steam heat; unlimited free supply of pure, soft water; all in good order; clean and ready for immediate use; cheap labor abundant. For further particulars apply to A. J PRIME, Esq., Yonkers. N. Y.

THE BENTEL & MARGEDANT COMPANY
MANUFACTURERS OF WOODWORKING MACHINERY
HAMILTON, O. U.S.A.

ELECTRICITY

is the most economical and convanient power for Machine Tools

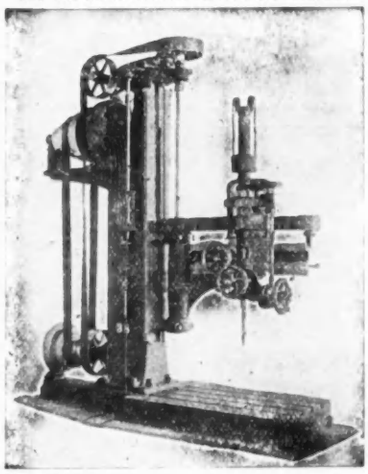
The Best Motor made is

THE "KEYSTONE."

Can be Direct Connected, Belted or Geared.

Adapted to all kinds of machinery.

CUT SHOWS IT APPLIED TO A RADIAL DRILL.



KEYSTONE ELECTRIC CO.,

Erie, Pa., U. S. A.

NEW YORK. BOSTON. CHICAGO.

and would like to hear from concerns building such class of tools.

The Detroit (Mich.) Soap Company contemplates the erection of a new factory to cost $40,000.

The Standard Pneumatic Tool Company, Chicago, contemplates an extension of its plant in the fall.

Murphy, Wasey & Co., of Detroit, Mich., contemplate the erection of a new factory, 85x240 feet, which will cost $30,000. It will be equipped with modern machinery.

The St. Joseph (Mo.) Plow Company will erect two new additions to the plant and install new machinery for manufacturing plows and agricultural implements.

The National Boiler Works, Syracuse, N. Y., has been organized by W. H. Wood, of Media, Pa., and Robert Joy, formerly with Thompson Kingsford, Syracuse, N. Y.

Machinery is being placed in the Penn Hardware Company's plant, Reading, Pa., for a new industry, the manufacture of wire nails. The company expects to turn out forty kegs of nails per day.

The Parker-Wishart-Hall Company, manufacturers of machine tools and special machinery, Stamford, Conn., has consolidated its plant with the Aluminum Plate and Press Company, Plainfield, N. J.

Recently the Buffalo Manufacturing Company filed articles of incorporation with the Secretary of State. The capital stock is placed at $30,000, and the objects of the company are to establish a flouring mill and electric light plant at Buffalo, Wyo. The trustees are Charles J. Hogerson, Ed. D. Metcalf and W. J. Thom.

The machine and repair shops of the Central Railroad of New Jersey, which was burned several weeks ago, it is said, will be rebuilt, and the excavations for the foundations will be begun next month. It is said that the plant will be built on the north side of the Central Railroad tracks at Elizabethport, N. J.

Articles of incorporation were filed recently in the Camden (N. J.) County Clerk's office by the Cross Stitch Button Sewing Machine Company. The objects of the corporation are to manufacture button sewing and other machines. The capital is $300,000, and the corporators are Walter M. Lefevre, William F. Dill and John H. Hamilton.

Beaman & Smith, of Providence, R. I., are erecting a new machine shop 60 feet wide and 130 feet long, with lean-to addition 20 feet by 50 feet. The construction will be modern in every respect. The framework of the building is arranged with a view of easy attachment of shafting and counter-shafting for the transmission of power. The entire building was designed and the steel work is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The A. A. Griffing Iron Company, Jersey City, N. J., sends us catalog of steam specialties, including steam traps, separators, feed water heaters, etc. The catalog is 3½x6½ inches.

We have received copy of 1898 catalog of Sawyer & Massey Company, Ltd., Hamilton, Ont., in which are described traction engines, separators, pneumatic stackers and various other agricultural machines. The catalog is 8¼x9¼ inches.

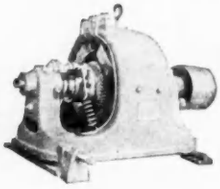
From Caldwell-Wilcox Company, Newburgh, N. Y., we have received catalog of valves of various types, including gate, stop and check valves. Other steam fittings, such as expansion joints, water catchers, pipe fittings, &c., are shown. The catalog is 5x8¾ inches.

The Most Perfect Motors for Economical Power Service.

Tesla Polyphase Induction Motor. Type "C."

The Only Motor Supplying Niagara Power in Buffalo.

Direct Current



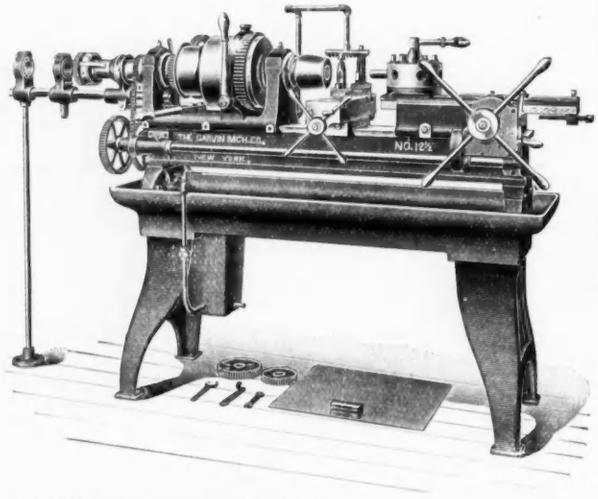
Multipolar Motor.

Direct Current Dust Proof Motor.

Same General Design as the Westinghouse Multipolar Motors.

Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

New York, Atlanta, Austin, Boston, Buffalo, Chicago, Cincinnati, Philadelphia, St. Louis, San Francisco, Syracuse, Tacoma. Denver, Mountain Electric Co. Canada, Ahearn & Soper, Ottawa. Mexico, G. & O. Braniff & Co., City of Mexico. Westinghouse Electric Co., Ltd., 32 Victoria St., London.



No. 12½ Extra Capacity

Screw Machine

WITH

WIRE FEED, FRICTION HEAD AND POWER FEED TO TURRET.

Wire feed capacity, $1\frac{5}{16}$ inches.
Size of hole in spindle, $2\frac{5}{16}$ inches.
Swings, 14 inches.
Length that can be milled, 8 inches.
Width of belt on two-step cone, 4 inches.
Weight of machine, 1,650 lbs.

LARGE STOCK OF ALL SIZES OF

EXTRA CAPACITY SCREW MACHINES.

Send for new Catalogue, now being printed

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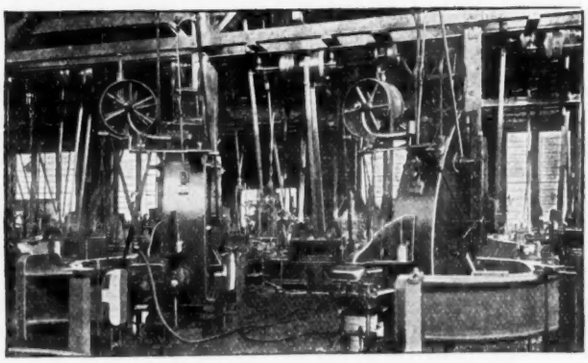
The Garvin Machine Co.,

Philadelphia Store—THE GARVIN MACHINE CO., 51 North 7th Street, Philadelphia, Pa.
Berlin Store—THE GARVIN MACHINE CO., m. b. H., 17 Burg Strasse, Berlin, C., Germany.
Agents for Great Britain—C. W. BURTON, GRIFFITHS & CO., 23A Ludgate Hill, London, E.C., England.

Spring and Varick Streets, NEW YORK.

Electric Motors FOR Machine Tools.

Electric Equipments FOR Mills of All Kinds.

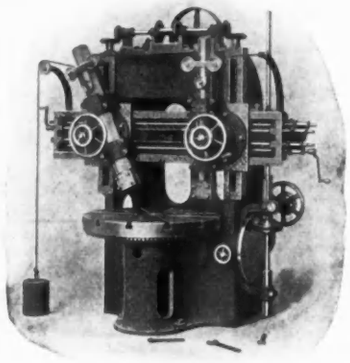


Slotting Machines driven by General Electric Motors.

General Electric Company

SCHENECTADY, N. Y.

Sales offices in all large cities in the United States.



37 INCH BORING AND TURNING MILL.

MACHINE TOOLS.

THE NILES TOOL WORKS CO.,

Hamilton, Ohio, U. S. A.

CABLES: NILES, HAMILTON, OHIO

BRANCHES:

New York. Philadelphia. Boston. Pittsburg. St. Louis. Chicago.

39 Victoria Street, London, S. W.

If there's one Turret Lathe better

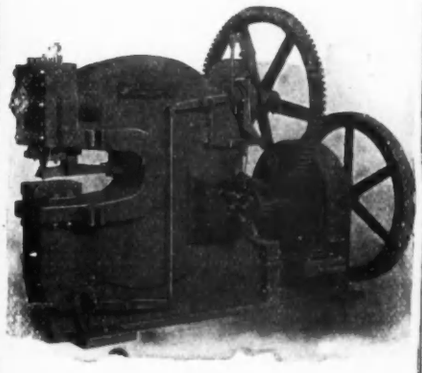
than another, it's the No. 2 Improved Turret Lathe made by the American Tool & Machine Co. The fact that this lathe is made by the American Tool & Machine Co. is sufficient guarantee for quality and workmanship, and we'll afford the testimony of users as to their money-making features. Suppose that you write us this afternoon asking for details and illustrations? Find out about it even if you don't buy.

American Tool & Machine Co.,

Boston, Mass.

Founded 1845. Incorporated 1864.

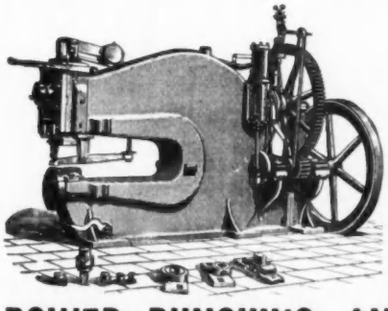
The Bullock Electric Mfg. Co.

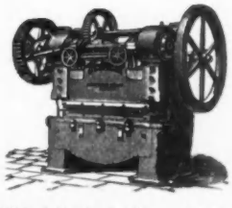


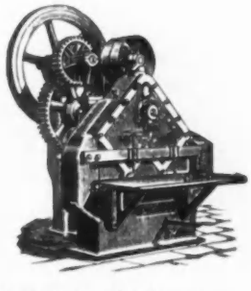
BULLOCK MOTOR DRIVING PUNCH.

CINCINNATI, O.

The LONG & ALLSTATTER CO., HAMILTON, OHIO, U. S. A.







Belt, Steam and Electrically Driven **POWER PUNCHING AND SHEARING MACHINERY** Of Every Description.

PRESSES

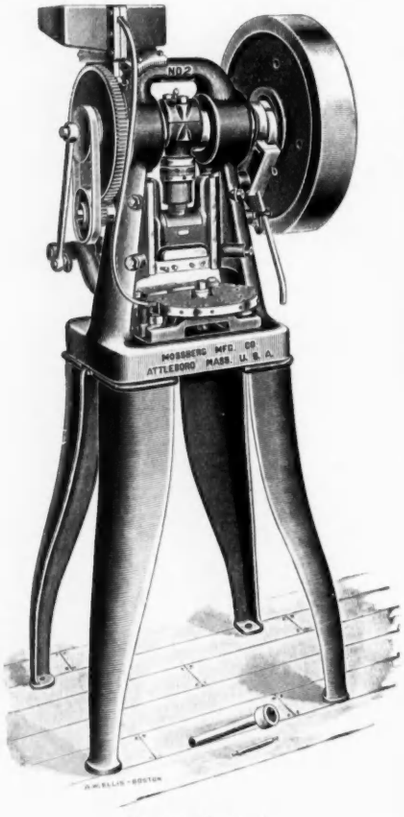
WITH

Automatic Feed

save their entire cost
in a short time.

This press was designed for sizing the hole in rollers for bicycle chain and work of a similar nature.

You keep the hopper full—the machine will do the rest.



No. 2. Style A.

Capacity, 120,000 per day.

Send sample for particulars and prices.

Mossberg & Granville Mfg. Co.,

Providence, R. I.

126 Liberty Street, New York.

Exhibit at Philadelphia Bourse.

Chas. Churchill & Co., London.
Schuchardt & Schutte, Berlin.
Mathey Doret, Chaux-de-Fonds, Switzerland.
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Hydraulic Tools.

Probably the Watson-Stillman Co. make and sell more Hydraulic Tools every year than any other two combined concerns. Why? Well, for forty different reasons: Quality, workmanship, reliability, price, promptnesss of delivery, a long experience in the making of such tools, &c. These tools are for every possible purpose.

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Selig, Sonnenthal & Co., Londen.

CUSHION BEARING GRINDER.

Write for information on its advantages over other grinders.

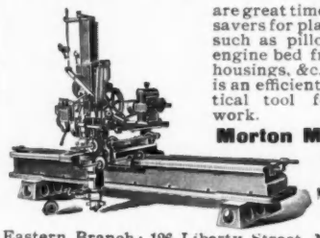
EMERY WHEELS

AND GRINDING MACHINERY.

The Safety Emery Wheel Co.

SPRINGFIELD, OHIO.

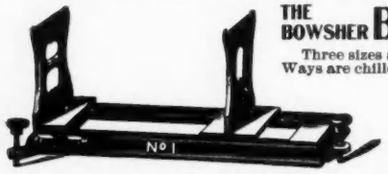
Morton's Portable Planers



are great time and labor savers for planing work such as pillow blocks, engine bed frames, roll housings, &c.; in fact it is an efficient and practical tool for heavy work.

Morton Mfg. Co., Muskegon Heights, Mich., U.S.A

Eastern Branch: 126 Liberty Street, New York, N. Y.; Walter H. Foster, Manager.
Glasgow Office: 40 St. Enoch Square; James Ritchie, Manager.
Schuchardt & Schutte, Berlin, Vienna, Brussels.
Adphe. Janssens, Paris, France.



THE BOWSHER Balancing Way, For balancing Armatures, Pulleys, Cutter Heads and all rotary parts of machinery.

Three sizes and styles for bench and floor use. Ways are chilled and ground. Spirit levels attached.

YOU GET AN ABSOLUTE LEVEL IN TEN SECONDS. A TIME SAVER. PAYS FOR ITSELF IN 30 DAYS.

Ask for Circular Q.

N. P. Bowsher Co., South Bend, Ind.

28 in. and 32 in.

Engine Lathes

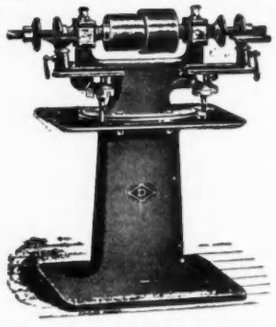
are a specialty with Fay & Scott, and they're good lathes—lathes as good as anyone makes.

The prices on these lathes are very interesting and will be furnished on application.

Fay & Scott,

Dexter, Maine.

Hill, Clarke & Co., Boston.
Prentiss Tool & Supply Co., New York.



Good machinery with skilled labor means good work. We can furnish you the very best Grinding machinery of all classes, from little Bench Grinders to big Universal and Surface Machines. Send for our Catalogue.

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Paris: FENWICK FRERES.
Berlin: SCHUCHARDT & SCHUTTE.
Copenhagen: V. LOWENER.

The Walker Cutter and Reamer Grinder.

This is a tool that will earn its cost in a short time. It is for grinding to size straight and taper lathe arbors, small spindles, cutter and reamer blanks, discs, gages, etc. Particulars on request.

Norton Emery Wheel Co.,

Worcester, Mass.

PLANERS

SECOND-HAND.

FOR IMMEDIATE SHIPMENT.

48 in. x 10 ft. Gray Co.'s, spiral geared, latest pattern, two heads, good as new.
48 in. x 16 ft. Putnam Machine Co.'s, one head, first-class order.
40 in. x 12 ft. Fitchburg Machine Co., one head, good order.
40 in. x 10 ft Pond, one head, good order.
36 in x 12 ft. Wm. Sellers & Co., one extra side head, good order.
36 in. x 8 ft. Bement, one head, good order.
30 in x 8 ft. Gleason, good as new.
30 in. x 10 ft. Rochester Tool Works.
26 in. x 9 ft. Miles Machine Tool Works.
26 in. x 6 ft. Putnam Machine Co.
22 in. x 5 ft. Putnam Machine Co.
16 in. crank planer, Lathe and Morse.

Some of these planers are still in use and will be sold low before moving.

Large assortment of Lathes, Planers, Shapers, Upright and Radial Drills, Universal Grinders, Milling Machines, Screw Machines, Presses, Hammers, &c.

J. J. McCABE,

14 Dey St., NEW YORK.

SECOND-HAND MACHINERY.

ENGINE LATHES.

Stark Bench Lathe, slide rest, countershaft and chucks.
9 in. Screw Cutting Bench Lathe, with spring chks.
14 in. x 6 ft. Pratt & Whitney, rise and fall rest, taper attachment.
14 in. x 6 ft. Grant & Bogart, rise and fall rest.
15 in. x 6 ft. Perkins, taper attachment.
16 in. x 6 ft. Blaisdell, rise and fall rest.
18 in x 8 ft. Muller, compound rest and taper attachment.
22 in. x 13 ft. Blaisdell, compound rest.
24 in. x 12 ft. Powell.
24 in. x 10 ft. Fish, shop worn
22 in x 14 ft. English Gap Lathe, 42 in. gap.
39 in. x 8 ft. Powell, triple geared.
50 in. x 20 ft. Sellers, triple geared.
60 in. Henley Pulley Lathe, shop worn.

PLANERS.

36 in. x 36 in. x 10 ft. New Haven.
40 in. x 36 in. x 12 ft. New Haven.
52 in. x 29 in. x 12 ft. New Haven, two heads.
30 in. x 30 in x 8 ft. Pease.

TURRET & BRASS LATHES.

17 in. American Tool Co., round arbor, Fox.
15 in. Hendey plain turret lathe.
22 in. x 6 ft. Flather, back geared turret lathe
28 in. x 10 ft. Pratt & Whitney turret lathe.
No 4 Windsor Screw Machine, wire feed, friction back gears.

SHAPERS.

14 in. Juengst, crank.
18 in. Juengst, crank.
15 in. Hendey, friction.

DRILLS.

2 Sigourney, one spindle.
Garvin, four spindle.
No. 4 Pratt & Whitney, four spindle, aut. feeds.
32 in. Hamilton.

DRILLS,—(Continued.)

6 Sensitive Drills, Woodward & Rogers, Slate, etc.
Woodward & Rogers Bicycle Assembling Drill.

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No. 84 Toledo, double action, geared.
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3 small Punching Presses.
Combined Punch and Shear, for 1-2 in. work.

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No. 2 Becker vertical, rotary table.
No. 3 Hilles & Jones vertical, rotary table.
No. 10 Kempsmith hand miller.
No. 1 Prentiss hand miller.
No. 2 Kempsmith power miller, with centers.
No. 25 Brainerd, with centers.
Garvin Lincoln pattern.
Pratt & Whitney No. 2 Lincoln pattern.
Pond Index miller.
No. 12 Brown & Sharpe sprocket miller, vise, centers, dials, cutters, etc.
Special sprocket rim miller.
Beaman & Smith duplex miller.

MISCELLANEOUS.

36 in. Springfield Water Grinder.
Norton Cutter and Tool Grinder, with att'ments.
Yankee Twist Drill Grind.
1 National Bolt Cutter.
2 Spindle Ames Profiler.
2 in. Hurlbut & Rogers Cutting off Machine, accelerated speed.
400 lb. Williams-White Drop Hammer.
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Special Bicycle Hub Drill.
Rudolphi & Krummel Chain Tester.
Rudolphi & Krummel Wheel Assembling Mach.
Fox Rim Drill.
Large Brazing Furnace and attachments.
6 Chain Hoists.
50 Vises.

MARSHALL & HUSCHART MACHINERY CO.,

62 and 64 South Canal St., Chicago.

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NEW AND SECOND-HAND MACHINERY.

Lathes, from 12" to 48"; Planers, from 20" up to 60. 18", 54" and 60" Radial Drills; No. 2 Newton Milling Machine; No. 2 Screw Machine; Shapers, from 6" to 30", Boilermakers' Punches, Shears, Edge Planers, Rolls, Drills, Engines, Boilers, Pumps, and Dynamos.

FRANK TOOMEY, 131 N. THIRD ST., PHILA.

SECOND-HAND MACHINERY.

ENGINE LATHES.

13 in. x 6 ft. Ames.
14 in. x 6 ft. Blaisdell.
14 in. x 6 ft. Prentice.
15 in. x 5 ft. Sheperd.
16 in. x 7 ft. D. & H.
18 in. x 12 ft. Bogart
27 in. x 12 ft. Wood & Light.
28 in. x 12 ft. G. & E.
48 in. x 18 ft. Gay & Silver.

SCREW MACHINES.

No. 1 Wire feed.
No. 2 Wire feed.
No. 2 P. & W., plain.
No. 2 1-2 P. & W., wire feed.
No. 4 Windsor, plain
No. 4 Windsor, wire feed, auto.
No. 2 Niles, heavy.

PLANERS.

16 in. x 16 in. x 4 ft. Hendey.
22 in. x 22 in. x 4 ft. Pease.
24 in. x 24 in. x 4 ft. Wood & Light.
26 in x 26 in. x 5 ft. Powell, with chuck.
28 in x 28 in. x 8 ft. Gay & Silver.
30 in. x 30 in. x 6 ft Putnam.
60 in. x 60 in. x 22 ft. Hepworth.

SHAPERS.

9 in. Traveling head, Sellers
13 in. Traveling head, Bement.

SHAPERS.

14 in. Steptoe.
20 in. G. & E., with circular motion.

DRILLS.

6 spindle Quint.
Pond suspension.
22 in. G. & E., back geared.
32 in G. & E., back geared.
34 in. Harris, back geared.
38 in. Wood & Light.

MISCELLANEOUS.

24 in. Lead Lapping Machine
No. 2 Water Tool Grinder, Springfield.
Centering Machine, Whitton.
Double head Cam Miller, P. & W.
Special Cam Miller.
24 in. Gear Cutter, G. & E., half automatic.
36 in. Hand Gear Cutter, G. & E.
Lincoln Type Milling Machine, P. & W
48 in. x 12 ft. Hor. Boring and Drilling Machine.
16 in. x 8 ft. Pattern Makers' Lathe, milling machine attachment Fay & Scott.
12 in. Thompson Splitting Shear.
36 in. Band Saw, B. & O.
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We also offer a large stock of Shafting, Hangers and Pulleys, Benches and small tools at the shops of the United Machine Co., Irvington, N. J.

We have named above only our choicest tools.
Write us for anything you want.
Prices on application.

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SECOND-HAND GAS ENGINES.

1 16½ H. P. Slide Valve Otto Gas Engine, complete, with fly-wheel and belt pulley..... $275
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1 7 H. P. Charter Gas Engine, with base, fly-wheel and pulley..... 200
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S. M. YORK, Cleveland, Ohio.

We have rented

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Almost two hundred machines in stock.

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J. B. Doan & Co.,

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One 12 in. x 5 ft. Silk lathe, good as new.
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One 16 in. x 8 ft. Draper lathe, good as new.
One 16 in. x 8 ft. Hatfield lathe, good as new.
One 18 in. x 6 ft. Davis & Egan lathe, good as new.
One 18 in. x 8 ft. Lodge, Barker & Co. lathe.
One 19 in. x 7 ft. Lodge & Davis lathe, good order
One 20 in. x 12 ft. Davis & Egan lathe, good as new.
One 24 in x 12 ft. Hatfield lathe, good as new.
One 26 in. x 12 ft Fifield lathe, good order
One 27 in x 12 ft. Lodge & Davis lathe good as new
One 30 in. x 10 ft. Lodge & Davis lathe, good order.
One 38 in. x 20 ft Lodge & Davis lathe, good order.
One 50 in. x 20 ft. Fifield lathe, good as new.

PLANERS.

One 22 in x 22 in x 6 ft. Flather planer, good as new.
One 24 in x 24 in. x 6 ft Davis & Egan planer, good as new.
One 24 in. x 24 in. x 10 ft. Davis & Egan planer, good as new.
One 30 in. x 30 in x 8 ft. Pease planer, good order
One 30 in. x 30 in. x 8 ft. Powell planer, good order.
One 36 in x 36 in. x 12 ft. Smith-Silk planer, two heads, good as new
One 42 in. x 42 in. 16 ft. Pond planer, 2 h'ds, good as new.

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One 25 in Standard drill, back geared, power feed, good as new.
One 28 in. drill, B. G. P. F. National, good as new.
One 32 in. drill, B. G. P. F. National, good as new.
One 72 in combination radial drill, good order.
One 4 ft. plain radial drill.
One 5 ft. Davis & Egan plain radial drill, good order

SHAPERS.

One 12 in. Smith & Mills shaper, good as new.
One 15 in. Davis & Egan shaper, good as new.
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One 26 in. Davis & Egan shaper, good as new.

MILLING MACHINE.

One No 2 Davis & Egan plain milling mach., good as new.

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One 7-8 in. screw machine, good as new
One 1 1-4 in screw machine, good as new.
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MISCELLANEOUS.

One 16 in. x 5 ft. plain head Monitor lathe, good as new.
One 5 in cutting-off machine.
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Successors to the Davis & Egan Machine Tool Co.,

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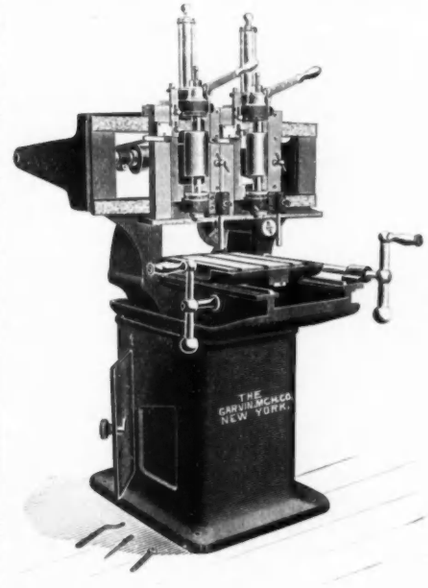

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Two Spindle Profilers.

Made in two sizes.

Metal Working Machine Tools

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Send for New Catalogue.

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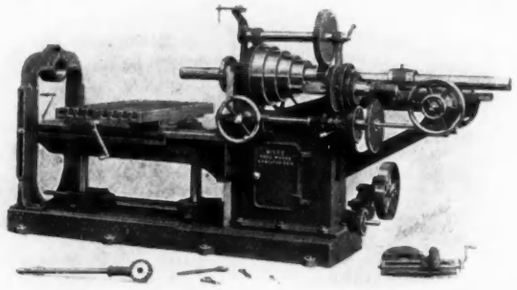
THE NILES TOOL WORKS CO.

CABLE ADDRESS:

"Niles, Hamilton, Ohio."

ILLUSTRATION SHOWS OUR

No. 2½ (60 in.) Horizontal Boring and Drilling Machine No. 4169.



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of... ERIE,

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BOSTON, NEW ORLEANS, WELLSVILLE, O.

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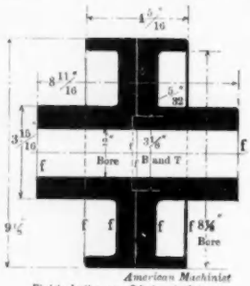
SPECIAL MILL AND ELEVATOR MOTORS. **Estimates quickly made.**



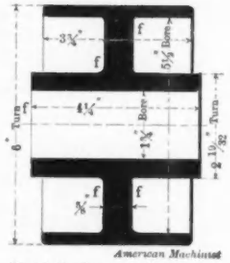
American Machinist

Finished all over. 2 halves in 1 hour

No. 4

6 to 1.

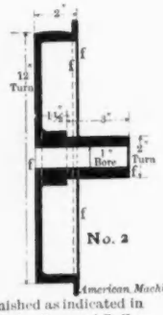
It will take from two to six ordinary lathes to handle the work that can be produced on one Gisholt Turret Lathe when it comes to a matter of duplicate work to be bored, faced, turned or threaded. The Gisholt Book tells the story at length. Sent free on request.



American Machinist

Finished all over in 35 minutes

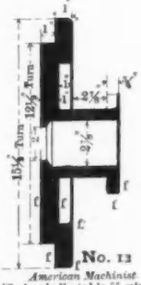
No. 7



American Machinist

Finished as indicated in 42 min. Crowned Pulley

No. 2



American Machinist

Finished as indicated in 55 min. This is an average of 8 pieces, and includes setting tools.

No. 12

Gisholt Machine Co., Madison, Wis., U. S. A.

Eastern Branch, 126 Liberty St., New York; Walter H. Foster, Manager.
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Penwick Frères, 21 Rue Martel, Paris, France.
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THE BECKER VERTICAL MILLING MACHINES

Built ONLY by John Becker Mfg. Co. Fitchburg, Mass.

Drop us a line if you are unacquainted with them.

J. W. Cregar, The Bourse, Philadelphia, Pa. U. Baird Machinery Co., Pittsburg. Hill, Clarke & Co., Chicago.
Selig, Sonnenthal & Co., London. Schuchardt & Schutte, Berlin, Vienna and Brussels. Roux Freres & Co., Paris.

No. 120 M. EXPANDING SHELL REAMERS.

What you are seeking for is here.—HORACE.

MORSE TWIST DRILL AND MACHINE CO.,

NEW BEDFORD, MASS., U. S. A.

MANUFACTURERS OF

TWIST DRILLS, CHUCKS, REAMERS, MILLING CUTTERS,

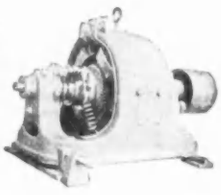
TAPS AND DIES, AND MACHINISTS' TOOLS.

The cut shows the construction of the Expanding Shell Reamer. Wedge-shaped pins are adjusted to the blades and driving the pins increases the diameter of the Reamer. When new blades or pins are required, the Reamer should accompany the order. The Reamers can be increased but not reduced in size. Special sizes of larger diameter than 4 inches furnished to order.

Direct Current "Engine-Type" Generator.

I-deal in Simplicity of Construction and Operation.

Direct Current Multipolar Motor.



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Henderer Jacks and Expanders.

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85 Maryland Avenue.

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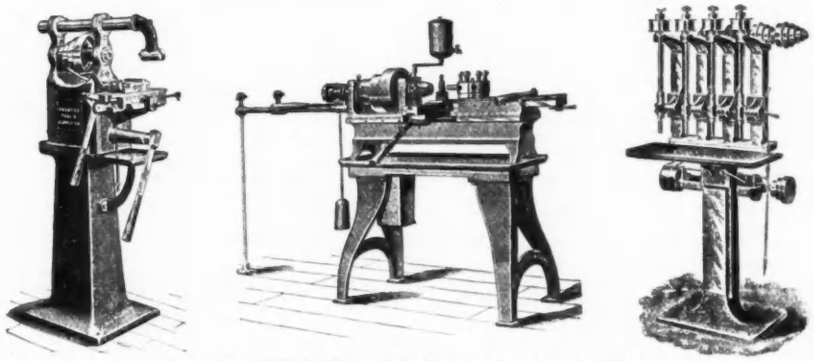

LATHES, PLANERS, DRILLS, SHAPERS, MILLING AND SCREW MACHINES, ETC., ETC.

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Nothing like it for information.

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ENGINE LATHES,
IRON PLANERS,
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New, also nearly good as new.
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Manufacturers,

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CHICOPEE, MASS.

The following are a few of the tools that may be seen at above place:

Wilmarth Pit Lathe.
Turning Lathe, 90 in. x 20 ft.
Pond Planer, 60 in. x 60 in. x 11 ft.
Sellers Planer, 48 in. x 48 in. x 16 ft.
Nos. 1, 2 and 2½ P. & W. Screw Machines.
22 in. x 8 ft. Heavy Screw Machine, friction head.
3 in. Hurlbut-Rogers Cutting-off Machine.
Cold Saw Cutting-off Machine.
Stiles & Parker Punching Press, No. 4.
Stiles & Parker Punching Press, No. 5.
500 pound Drop Hammer.
850 pound Drop Hammer.

SEND FOR COMPLETE LIST.

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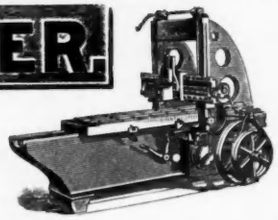
THE GRAY PLANER.



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Planers only! Nothing but Planers!!

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NOTE.—An important feature of our **MODERN LABOR-SAVING MACHINE TOOLS** is the convenient grouping of all of the operating levers and handles, thereby permitting the attendant to make necessary changes with rapidity and ease. This is one of the little details of construction which conduces not a little to the large capacity for work of our machine tools, as well as to the comfort of the operatives.

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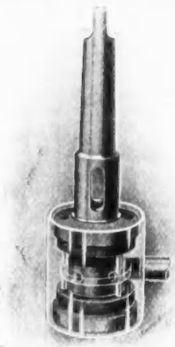

Chucks for Taper Shank Drills, with provision for conveying Lubricant to Cutting Lips.

By the use of these Chucks drills of this type can be used in an ordinary drill press, the lubricant being supplied by a small rotary pump.

The sleeves of these chucks being packed with cupped leather packings are tight and do not leak the lubricant under pressure.

To secure the full advantages of this system of drilling, the lubricant should be supplied under considerable pressure, which the construction of the chuck illustrated admits.

Made for Nos. 2, 3, 4, 5 Morse Taper. Prices on application.

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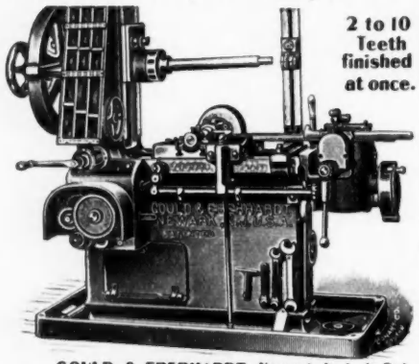
GEAR CUTTERS

and "Radial Duplex" Gang Cutters.



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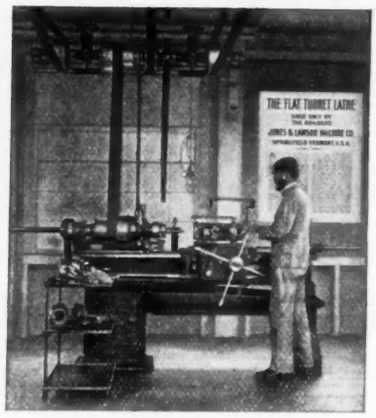
Their ad. will appear next week.



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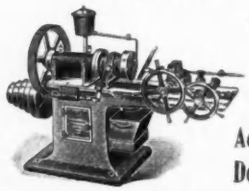

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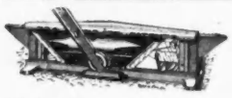

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